BANGALORE WATER SUPPLY AND SEWERAGE BOARD

CAUVERY BHAVAN, KEMPEGOWDA ROAD,
BANGALORE – 560 009

Tender for the work of Extending Additional Raw Water Pipeline of 3200mm dia from Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake.

Office of the *Chief Engineer (Kaveri-O&M)*
BANGALORE WATER SUPPLY & SEWERAGE BOARD
8th Floor, Cauvery Bhavan
K.G.Road,
Bangalore -560009.

Telephone – 080-22945263
e-mail –cekoandm@bwssb.gov.in
Website **www.kppp.karnataka.gov.in**

TENDER REFERENCE :	:	Tender for the work of extending additional raw water pipeline of 3200mm dia From Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake. IFT No.: BWSSB/CEK(O&M)TE/TA-01/80/2024/818/2025-26 Dated:25.08.2025	
PERIOD OF Download OF TENDER DOCUMENT	:	From: 28/08/2025	To: 26/09/2025
LAST DATE FOR Download OF TENDER DOCUMENT	:	26/09/2025 13:00 hrs	
LAST DATE AND TIME FOR Submission / Uploading OF TENDERS	:	26/09/2025 up to 15:00hrs	
TIME AND DATE OF OPENING OF TECHNICAL TENDERS	:	29/09/2025 up to 16:00 hrs	
DATE OF PRE_BID MEETING	:	11/09/2025 at 15:00hrs	
TIME AND DATE OF OPENING OF PRICE TENDERS	:	03/10/2025 at 16:00 hrs	
ADDRESS FOR COMMUNICATION	:	Office of the Chief Engineer (Kaveri-O & M), Bangalore Water supply and Sewerage Board, 8th Floor, Kaveri Bhavan, Kempegowda Road, Bangalore-560 009.	

Contractor
Employer

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BANGALORE WATER SUPPLY AND SEWERAGE BOARD

Office of The Chief Engineer (Kaveri-O&M), 8th Floor, Cauvery Bhavan ,K.G.Road, Bangalore -09

Website **www.kppp.karnataka.gov.in**

Telephone: 080- 22945263

SECTION 1:

INVITATION FOR TENDER (IFT)

(Through Karnataka Public Procurement Portal Only)

IFT No.: BWSSB/CEK(O&M)TE/TA-01/ 80/2024/ 818 /2025-26 Dated:25 /08/2025

1. The ***Chief Engineer (Kaveri-O&M)*** invites tender from eligible tenderers, for the construction of work detailed in the Table below through **Karnataka Public Procurement Portal** process with two stages tender procedure in line with the Rule28 of the KTPP Act. The details regarding their qualification to take the tender (as detailed in ITT Clause 3 and 6) and the price tender shall be uploaded in the website of the e-procurement wizard. Technical details will be opened on the date and time mentioned in IFT clause 5 and evaluated. The price tender of the Tenderer, who is found to be qualified to execute the tendered works, will be opened on the date notified later. The Tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to Tenderers (ITT) to qualify for award of the contract.

2. Tender documents may be downloaded through the e-procurement wizard which will link to **www.kppp.karnataka.gov.in** **from 28/08/2025 to 26/ 09 /2025,** on payment of a non-refundable fee indicated in the Table below, using any of these forms of OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only**.** Interested tenderers may obtain further information at the Office of e-procurement. Tenderers will be issued a password and authorized for accessing the tender document in the website with URL: **www.kppp.karnataka.gov.in**

3. The Bidders can download the e-tender document using their user ID –password, by accessing **www.kppp.karnataka.gov.in** where electronic tender form is provided. Additional information related to e-tender process can be obtained through the above mentioned website. The electronic tender will be operated as Two stage Tender system by opening the Technical details first and financial portion of the eligible tenderers later.

4. Tenders must furnish Earnest Money Deposit specified for the work in the Table below. Earnest Money Deposit will have to be paid through any one of the forms OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

Sl. No	Name of Work	Cost of Tender Document Rs.	Amount put to Tender Rs. in Lakh (Approx) (Excluding GST)	Bid Security Rs. in Lakh	Period of completion	Eligibility Criteria during last 5 **years (2020-21, 2021-22 , 2022-23,2023-24 & 2024-25)**	
						Average Annual Turnover (in all classes of Civil Engineering construction works) for any of the two financial years Rs. in Lakhs	Performance & Work Qualification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Tender for the work of extending additional raw water pipeline of 3200mm dia from Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake.	To be specified by e-procurement cell.	Rs. 9473.30 Lakhs	**95 lakhs**	**18** months (Including monsoon period)	Please refer clause 2&3-Qualification of the tenderer under ITT.	

5. The last date for uploading of completed tender document is on **26 /09 /2025** upto **1500 hrs.**
6. The bids will be opened at the office mentioned in para no.12 on **29/ 09 /2023** at **1600 hrs** in the presence of bidders or their authorized representatives. If the bid opening day remains as public holiday, Bids will be opened on the next working day at the original stipulated time.
7. Bidders can access tender documents from the website and upload the required details; those are mentioned in different sections in the bid document in to electronic tender box on the website. Scanned documents those are required to be furnished as per Section 2, 3 & 4 of the bid document shall be submitted through e-portal preferably in **PDF** format for clear vision.
8. The cost of the tender document once paid will not be refunded.
9. The successful bidder would be required to give performance **bank guarantee of 5%** of the contract amount plus additional security for unbalanced bid amount from a Nationalized / Scheduled Indian Bank, with jurisdiction at Bangalore as specified in the clause no.29 of ITT, towards guarantee for completion of work within the stipulated period.
10. **Bids from joint venture Firms limited to two are acceptable.**

Contractor
Employer

11. Bangalore Water Supply and Sewerage Board reserve the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reason.

12. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours 1030hours to 1700 hours.

The Chief Engineer (Kaveri-O&M),
Bangalore Water Supply and Sewerage Board
8th Floor, Cauvery Bhavan D- Block,
Kempe Gowda Road, Bangalore – 09 Karnataka, India.
Telephone: +91-80- 22945263
Or **visit Website www.kppp.karnataka.gov.in**

13. List of documents to support qualification of bidder is to be uploaded to the e-Portal website **www.kppp.karnataka.gov.in**

14. Pre-tender meeting:

8.2.1 The tenderer or his authorized representative is invited to attend a pre-tender meeting which will take place at **Office of the Chief Engineer (K O&M), Cavery Bavan, 8th Floor, Bangalore on 11 /09 /2025 at 15:00 hrs**

14. Other details can be read from the tender documents.

Sd/-
Chief Engineer (Kaveri-O&M),
Bangalore Water supply and Sewerage Board
8th Floor, Kaveri Bhavan,
Kempegowda Road, Bangalore-09

SECTION 2:

INSTRUCTIONS TO TENDERERS (ITT)

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A. General

1. Scope of Tender

1.1 The ***Chief Engineer (Kaveri-O&M),*** (Referred to as Employer in these documents) invites tenders following Two Cover e-Procurement procedure, from eligible Tenderers, for the construction of work (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are acceptable. **Joint Ventures (JV).**

2.2.1 **Eligibility:** If the Tenderer's comprises a number of firms combining their resources in a joint venture, the legal entity constituting the joint venture and the individual partners in the joint venture shall meet the requirement of Clause 2.1 above.

2.2.2 **Qualification Criteria:** The joint venture must satisfy collectively the criteria of clause 3. For this purpose the following data of each member of the joint venture may be added together to meet the collective qualifying criteria:

(a) average annual turnover (Sub Clause 3.1.1[b]).
(b) financial means (Sub Clause 3.1.3(a), 3.1.3(b) and 3.1.3(c).
(c) personnel capabilities (Sub Clause 3.1.4).
(d) equipment capabilities (Sub Clause 3.1.5).

Each Partner must satisfy the following criteria individually.

(a) General construction experience for the period of years stated in Sub-Clause 3.1.1(a)
(b) Adequate sources to meet financial commitments on other contracts (Sub Clause 3.1.3). and as stated in Sub-Clause 2.2.5.
(c) Financial soundness (Sub Clause 3.1.3(b) & as stated in Sub Clause 2.2.5).
(d) Litigation history (Sub Clause 3.1.6).
(e) Tender Capacity Sub Clause 3.1.8 & as stated in Sub Clause 2.2.5.

In accordance with the above, the Application shall include all related information required under Clause 3 for individual partners in the joint venture.

2.2.3 **Partner in Charge:** One of the partners, who is responsible for performing a key function in contract management or is executing a major component of the proposed contract, shall be nominated as being in charge during the pre-qualification and tendering periods and in the event of a successful tender, during contract execution. The partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture; this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners.

2.2.4 Partner Limitation: The number of partners in a JV is **Lead + One (1) (Partner)**; however, the attention of Tenderers is drawn to the provisions of Sub-Clause 2.2.5.

2.2.5 Joint and Several Liability: All partners including lead partner of the joint venture shall be legally liable, jointly and severally, during the tendering process and for the execution of the contract in accordance with the contract terms, and a statement to this effect shall be included in the authorization mentioned under Sub-Clause 2.2.3 above. To enable the above, the partner of the joint venture shall meet minimum 25% of the qualifying criteria and Lead Partner shall meet minimum 50% of the Qualifying criteria specified in sub-clauses 3.1.1.(b), 3.1.3 and 3.1.8 below. All members of the joint venture must have experience in execution of similar works stated in sub-clause 3.1.1 (a).

On successful award of contract, the Lead Partner shall have the registered office in India in the firm name before signing the Contract. A Company/ Organization/ J V Partner cannot assign any right and obligation of a project to its subsidiary/associate.

2.2.6 **Joint Venture Agreement:** A copy of the Joint Venture Agreement (JVA) entered into by the partners shall be submitted with the Application. Pursuant to Sub-Clauses 2.2.1 to 2.2.3 above, the JVA shall include among other things: the JV's objectives; the proposed management structure; the contribution of each partner to the joint venture operations; the commitment of the partners to joint and several liability for due performance; recourse/sanctions within the JV in the event of default or withdrawal of any partner; and arrangements for providing the required indemnities.

3. Qualification of the Tenderer:

3.1 **All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification information.**

Tenderers meeting all the following minimum pass–fail criteria regarding their general and particular construction experience, financial position, personnel and equipment capabilities, and other relevant information as demonstrated by the Tenderers responses in the Forms provided in section 3. The qualifications, capacity, and resources of proposed subcontractors will not be taken into account in assessing Tenderers.

3.1.1 **<u>General Construction Experience:</u>** The Tenderers shall provide evidence that (a) it has been actively engaged in the civil works construction business for at least the last five years prior to the date of submission of applications, in the role of prime contractor, management contractor, partner in a joint venture, and

(b) The Tenderer must have achieved minimum average annual turnover (in all classes of civil engineering construction works only) of **Rs.14905 lakhs** in any two financial years calculated as total certified payments received for contracts in progress or completed, within the last 5 financial years i.e. 2020-21 to 2024-25.

The average annual turnover is defined as the total of certified payment certificates for works in progress or completed by the firm or firms comprising the Tenderers, divided by the number of years.

Turnover of previous years shall be given a weight of 10% per year as given below

Financial Year Factor

2020-2021	1.61
2021-2022	1.46
2022-2023	1.33
2023-2024	1.21
2024-2025	1.10

3.1.2 **Particular Construction Experience (**In the last 5 financial years i.e. 2020-21 to 2024-25**.**

(a) **Contracts of Similar Size and Nature:** The Tenderer as sole entity or lead partner and or partner in a Joint Venture should have satisfactorily completed at least one Similar Contract such as work of one water supply gravity main pipeline project of value not less than **Rs.5590 lakhs**

(b) **Experience in Key Activities:** The Tenderers shall provide evidence that it has a minimum experience in the following key activities,

(i) **Construction Experience-Pipeline**

The Tenderer must have experience in the role of Prime Contractor (Single entity or JV member) in execution of Providing & Laying of Gravity Main ***water supply Pipeline*** of **3000mm dia** and above MS pipeline of length of **1.6Kms** and completed in all respect in drinking water supply project in any One year during the last 5 years.

(ii) **Construction Experience – Earth Work Excavation**

The Tenderer must have experience in the role of Prime Contractor (Single entity or JV member) in execution of Earth work excavation in Gravity Main water supply pipeline trenches in all types of soils with quantity not less than **48,474** cum in any One year during the last 5 years.

(iii) **Construction Experience – RCC**

The Tenderer must have experience in the role of Prime Contractor (Single entity or JV member) in execution of RCC quantity not less than **2850 cum** in any One year during the last 5 years.

(iv) **Construction Experience – Trenchless Works**

The Tenderer must have experience in the role of Prime Contractor (Single entity or JV member) in execution of Providing & Laying of **3200mm dia.** M S Casing Pipe through trenchless technology and completed in all respect in drinking water supply project of length of **19.2Rmt** in any One year during the last 5 years.

Experience: Notes for the Applicant

(i) A management contractor is a firm which takes on the role of contract management as a “general” contractor of sort could do. It does not normally perform directly the construction work(s) associated with the contract. Rather, it manages the work of other (sub) contractors while bearing full responsibility and risk for price, quality, and timely performance of the work contract.

(ii) The lead partner shall be given 100% experience while the other JV partners shall be given experience in proportional to their percent share of JV. For example, if a lead partner has 40% share in a three member JV with 40%:30%:30% share then the lead partner shall get a 100% experience while the other partners shall get experience in proportion to their share of JV. In case the JV is 50%:50% then both the JV members can claim 100% of the project experience.

(iii) The applicant shall submit end user certificate for successful completion in specific construction experience as of application submission date: for clause 3.1.2 (a, b (i to iv). All experience certificates to be provided with English Translation.

(iv) **In case of a JV, Partner should meet at least one of the criteria indicated under particular experience of 3.1.2.**

(vii) Sub-contractors experience and resources shall not be taken into account in determining the Tenderers compliance with the qualifying criteria.

Financial Year	Factor
2020-2021	1.61
2021-2022	1.46
2022-2023	1.33
2023-2024	1.21
2024-2025	1.10

3.1.3 **Financial Capabilities**

(a) **Minimum Required Cash Flow amount:** The Tenderers shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements for the subject contract in the event of stoppage, start-up, or other delays in payment, of the minimum **Rs.1865 Lakhs**, net of the Tenderers commitments for other contracts.

(b) In the relevant Information Form, the Tenderers shall also demonstrate, to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.

(c) The audited balance sheets or other financial statements acceptable to the Employer, for the last five years shall be submitted and must demonstrate the current soundness of the Tenderers financial position and indicate its prospective long-term profitability. If deemed necessary, the Employer shall have the authority to make inquiries with the Tenderers bankers. As a minimum, a Tenderers net worth calculated as the difference between total assets and total liabilities should be positive.

(d) Tenderer to upload latest Banker’s certificate valid till tender validity.

3.1.4 **Personnel Capabilities** The Tenderer shall supply general information on the management structure of the firm and shall make provision for suitably qualified personnel to fill the key positions listed below. The Tenderer must have qualified employed personnel to fill the following positions. The Tenderer shall supply information, of the personnel with relevant experience, on a prime experience requirement specified below: candidate and on an alternate for each position; both of whom shall meet the minimum experience requirements specified below:

Sl No.	Position	No of Position	Minimum Education
1	Project Manager	1	BE-Civil Engineering
2	Senior Engineer	1	BE-Civil Engineering
3	Senoir Engineer	3	BE-Mechnical Engineering
4	Site Engineers	4	BE/ Diploma-Civil/Mechanical Engineering

3.1.5 **Equipment Capabilities**

Each Tenderer should further demonstrate:

(a) Availability by owning 50% of the required / specified key and critical equipment for this work and remaining 50% can be deployed on lease / hire basis for all works provided, the relevant documents (commitment agreements etc.,) for availability for this work shall be furnished. Some of the equipments are:

(i)	Concrete mixers	-	2 no.
(ii)	Pin vibrators	-	2 no.
(iii)	De watering pumps	-	3 No
(iv)	Excavators	-	3 No
(v)	Compressors	-	2 no
(vi)	Tractors/ Tipper	-	4 no
(vii)	Welding Generator	-	1 no

(ix) Pipe laying accessories like tripod, chain pully etc.

3.1.6 **Litigation History** The Tenderer shall provide accurate information on any litigation or arbitration resulting from contracts completed or under its execution over the last five years. A consistent history of awards against the Tenderer or any partner of a joint venture may result in failure of the tender. The litigation history in particular with BWSSB shall also be provided.

3.1.7 **Approach and Construction Methods** The Tenderer must attach with their application, a note giving a general description on the approach to the construction methods, modification works, technologies, quality assurance schemes proposed, deployment schedule of equipment proposed to be used, etc., for ensuring completion of the work as per specifications within the desired timeframe.

3.1.8 **Tender Capacity**

Tenderers who meets the minimum qualifying criteria, will only be qualified only if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B)

where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to **2025-26** price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited.

B = Value, at **2025-26** price level, of existing commitments and on-going works to be completed during the next **1** years (period of completion of the works for which Tenders are invited)*

Note: **The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.**

3.2 Even though the Tenderers meet the above criteria, they are subject to be disqualified if they have:
- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

4. One Tender per Tenderer :

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one Tender (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Tenderers participation to be disqualified.

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible and liable for those costs.

6. Site visit:

6.1 The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tenderers own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2:

7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or by cable (hereinafter “cable” includes telex, facsimile and e-mail) at the Employer’s address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer’s response will be forwarded to all purchasers of the tender documents through e-mail, including a description of the enquiry but without

identifying its source. Same will available in the website of **www.kppp.karnataka.govt.in**.

8.2 Pre-tender meeting:

8.2.1 The tenderer or his authorized representative is invited to attend a pre-tender meeting which will take place at **Office of the Chief Engineer (K O&M), Cavery Bavan, 8th Floor, Bangalore on 11/09 /2025 at 15:00 hrs**

8.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage

8.2.3 The tenderer is requested to submit any questions in writing or e-mail to reach the Employer not later than one week before the meeting.

8.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the tender documents. Any modification of the tender documents which may become necessary as a result of the pre-tender meeting shall be made by the Employer exclusively through the issue of an Addendum.

8.2.5 Non-attendance at the pre-tender meeting will not be a cause for disqualification of a tenderer.

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1 The tender submitted in e-procurement by the Tenderer shall contain the documents as follows:

(a) Evidence of Earnest Money Deposit payment;
(b) Scanned copies of Qualification Information as per formats given in Section 3;
(c) The form of Tender (in the format indicated in Section 4) duly signed
(d) Priced Bill of Quantities (Section 9);

and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without

exception. The Earnest Money Deposit shall be submitted to the Tender inviting authority on or before the time of submission mentioned in IFT. ALL THE PHOTOCOPIES OF THE DOCUEMNTS SHOULD BE NOTARISED.

10.2 Tenderers submitting tenders together with other contracts stated in the IFT to form a package will so indicate in the tender together with any discounts offered for the award of more than one contract.

11. Tender prices

11.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

11.2 The bidder shall fill in the unit rates in figures for all items of the Works described in the Bill of Quantities. The system will automatically convert the unit rates mentioned in figures to words and also calculate the amount of that item as well as the total Bid value. *Items for which no rate is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates in the Bill of Quantities*

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates and excluding GST, prices and total Tender Price submitted by the Tenderer.

11.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 40 of the Conditions of Contract for the contracts with period of completion is more than 12 months.

12. Tender validity

12.1 Tenders shall remain valid for a period valid up to **ninety days** after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers responses shall be made in writing or by cable or e-mail. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 13 in all respects.

13. Earnest money deposit

13.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 4 of the Table of IFT for this particular work. EMD can be paid through OTC, NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

13.2 deleted

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or
(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
  (i) sign the Agreement; or
  (ii) furnish the required Security deposit

14. Format and signing of Tender

14.1 The completed bid comprising of documents indicated in ITB 12, should be uploaded in the e-procurement wizard of Government of Karnataka through "e-portal" along with scanned copies of requisite certificates those are mentioned in different sections in the bid document and EMD can be paid through OTC, NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

14.2 All the documents should be uploaded to the e-procurement wizard of GOK. Tenderer should take a print out of the declaration letters provided in the website on company letter head and should sign, stamp and upload the same to the e-procurement wizard.

14.3 Deleted

D. Submission of Tenders

15. Up-loading & submission of tenders

15.1 The tenders should be uploaded only through e-portal system. Tender should contain

A. Technical Tender consisting of following:

a. All the documents with required details in prescribed format; those are mentioned in different sections in the Tender. Form of Tender, Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2, etc., shall be downloaded, filled with required details, signed, scanned & uploaded to the e-procurement website **www.kppp.karnataka.gov.in** on or before the time and date indicated in notification /Section I IFT.

b. **Tender security.** Tender security can be paid in the form of OTC,NEFT,DEBIT CARD,CREDIT CARD in e-procurement of Govt. of Karnataka.

The above documents along with notarized copies of documentary evidences as indicated in Section—II ITT, Section-III Qualification information & Section IV Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete bid document and

B. Financial Tender consisting of Bill of Quantities (file name: BOQ.xls). The tenderer shall down load the bill of quantities and key in the rates (in figures only) in the Bill of Quantities sheet and upload the same file on to the website on or before the time and date indicated in notification /Section I IFT.

In case of failure of the tenderer to upload the same within stipulated time ie., **Dated:- 26/09 /2025**, their tender will be rejected.

NOTE:

1. URL of the Website for tender submission through e-Procurement & Address for uploading of Tender security are as follows:

i **www.kppp.karnataka.govt.in.**

ii The Chief Engineer (Kaveri-O&M), BWSSB, VIII floor, Cauvery Bhavan, KG Road, Bangalore - 560009
Telephone: +91-80- 22945263

2. The details related to submission of tenders, downloading / uploading of documents or other details are available online in the help wizard, Vendor manual & FAQ of above website. The same is provided along with sample formats in Annexure-I of the Bid document for ready reference.

15.2 Deleted

15.3 Unique Identification Number will be automatically generated by the server with time -stamp and sent to the account of the bidder as an acknowledgement after bidder finally uploads the bids.

15.4 Deleted

16. Deadline for submission of the Tenders

16.1 tenders should be uploaded only through e-portal system no later than **26/09/2025**. In the event of the specified date for the submission of tenders being declared a holiday for the Employer, the tenders will be received up to the appointed time on the next working day.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Clause 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 The software of e-procurement system will not allow the Bidder to upload the documents after expiration of the stipulated date & time of Bid submission. The Bidder shall refer the server time, which will be displayed in the e-procurement portal. Employer will not be responsible for non-receipt of bids on the stipulated date & time prescribed in clause 16, due to Internet Problems, improper uploading or any other related problems. In case of connectivity problems, Tenderer may contact Helpdesk of the e-tender service provider and may also draw the attention of tender inviting authority.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may “modify” and “withdraw” their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in e-tendering. If the Tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 16. In this case within the stipulated date & time, the tenderer can once again submit the requisition to the officer inviting tenders for access to the withdrawn tender document for resubmission. For this tenderer need not make any additional payment towards the cost of tender document. Communication of modification / withdrawal by other means will not be accepted.

18.2 Deleted.

18.3 No Tender may be modified after the deadline for submission of Tenders.

18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the forfeiture of the earnest money deposit pursuant to Clause 13.

18.5 Tenderers may offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. Tender opening and evaluation

19. Opening of Technical portion of Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open the Technical details of all the Tenders received (except those withdrawn), including modifications made pursuant to Clause 18, in the presence of the Tenderers or their representatives who choose to attend at 1600 hours on **29/09/2025** in the office of Chief Engineer (Kaveri-O&M), 8th Floor, Cauvery Bhavan 'D' Block, K.G.Road, Bangalore 560 009. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

19.2 WITHDRAWAL proposal submitted pursuant to clause 18 shall be read out first and their bids shall not be opened.

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3.

19.5 The Price Tenders of all the Tenderers including modifications for Financial tenders can not be opened as this is programmed to open later after evaluation of the Technical details of the participating Tenderers.

19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Second Cover of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the price Tenders. The Employer will open the price tender of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Price tender opening being declared a holiday for the Employer, the price tenders will be opened at the appointed time and location on the next working day.

20.2 Deleted.

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the

Employer at the opening. No Tender shall be rejected at Tender opening.

20.4 The Employer shall prepare minutes of the Price Tender opening, including the information disclosed to those present in accordance with Sub-Clause 20.3.

21. Process to be confidential

21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22 Clarifications of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer’s Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers’ Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents like [(a)Form of Tender, (b)Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2 etc.,] Scanned / uploaded [including documents those are required to be furnished as per Section 2, 3 & 4 of the tender,]; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the tendering documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which

affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

24.1 (a) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, rate in words will be auto generated by the system.

(b) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, the system will automatically calculate the amount of that item as well as the total Bid value.

24.2 Deleted

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

(a) making any correction for errors pursuant to Clause 24; and

(b) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 18.5.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer’s estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5% of the Contract

price plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract. :

- Cash or

- Banker's cheque/Demand draft,/Pay Order in favour of ***Chairman, BWSSB*** payable at ***Bangalore*** or

- A bank guarantee in the form given in Section 10;

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank.

29.3 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30 Advance Payment and Security:

30.1 The Employer will provide an advance payment on the contract price as stipulated in the Conditions of Contract, subject to the maximum amount as stated in the Contract Data.

31. Corrupt or Fraudulent practices

31.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK :

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

SECTION 3:

QUALIFICATION INFORMATION

QUALIFICATION INFORMATION

The following form is to be downloaded, particulars are to be filled, scanned & uploaded by the Bidder, to the e-procurement of Government of Karnataka wizard **"www.kppp.karnataka.gov.in"** along with the Bid.

Note: The detailed procedure for downloading / uploading the documents will be available in Help wizard, Vendor manual & FAQ of the above mentioned Website.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy]
Place of Registration _____
(Attach Copy)

Principal place of business: _____

1.2 Total value of civil engineering construction works executed and payments received in the last five years (in Rs. Lakhs)

2020 - 21 _____
2021 – 22 _____
2022 – 23 _____
2023 – 24 _____
2024 – 25 _____

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of contract Rs. Lakhs	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of Work	Name of Employer	Quantity of work performed (cum)			Remarks (Indicate contract reference)
			MS Pipeline	Reinforced Cement Concrete	Earthworks	
2020-21						
2021-22						
2022-23						
2023-24						
2024-25						

Contractor
Employer

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place & State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. lakhs)	Stipulated period of completion	Value of works remaining to be completed (Rs. lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. lakhs)	Stipulated Date period of completion	when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6. The following items of equipment are considered essential for successfully carrying out the works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement			Owned and available		Remarks
	No.	Capacity	Owned	Number/ Capacity	Age/ Condition	

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor’s reports for the last five years;

1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

ON BANKS LETTER HEAD

……

FORMAT OF BANKER'S CERTIFICATE /LINE OF CREDIT LETTER
[TO BE ISSUED IN THE LETTER HEAD OF THE BNK BRANCH]

Ref No.(Sl.No) Place:
Date:

To:
[Name and address of the beneficiary)

This is to certify that M.r/Ms. ……[name of the customer] having registered/administrative office at ……. ……..is a customer of our bank and is/are engaged in……[name of the activity]. If the said customer is allotted / awarded with……[brief details of works], we may extend credit facilities up to Rs……lakhs, to meet his/their working capital requirement towards the execution of the said work order as per the loan policy of the Bank.

This certificate is valid upto 3 months from the date of issue, that is up to dd/mm/yyyy.

Yours faithfully,

Branch Manager
Address:……

1.11 Proposals for subcontracting components of works amounting to more than 20% of the contract price .

Item of Work	Value of Sub-Contract	Identified Sub-Contractor (Name and address)	Experience of similar work

1.12 Information on litigations in which the Tenderer is involved:

Other Party (ies)	Employer	Details of dispute	Amount involved	Remarks showing present status

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

SECTION 4:

FORMS OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works: Tender for the work of extending additional raw water pipeline of 3200mm dia From Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake.

Tender

To

Chief Engineer (Kaveri-O&M)
Bangalore Water Supply & Sewerage Board
8th floor, Cauvery Bhavan
K.G.Road, Bangalore -560009

GENTLEMEN,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price uploaded for this tender to be opened after qualification.

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

The advance payment required is Rs.....

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory:

_____

Name of Tenderer _____

Address: ----------

NOTE: This form shall be download, filled and printed on the Company letter head, signed, Scanned and uploaded. Failure to furnish the signed copy will lead to Non-Responsive Tender.

Letter of Acceptance

(letterhead paper of the Employer) _____[date]

To: _____[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the _____ [name of the contract and identification number, as given in the Instructions to Tenderers] for the Contract Price of Rupees —— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.———— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ..... and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of Agency

Issue of Notice to proceed with the work

(letterhead of the Employer)
———— (date)
To
————————————— (name and address of the Contractor)
—————————————
—————————————

Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of ———————[name of the contract] a Tender Price of Rs.———————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form

Agreement

Contractor
Employer

This agreement, made the _____day of _____20_____, between_____ _____[name and address of Employer] (hereinafter called “the Employer”) of the one part and _____ _____ _____ _____ _____[name and address of contractor] (hereinafter called “the Contractor”) of the other part.

Whereas the Employer is desirous that the Contractor execute _____ _____ _____[name and identification number of Contract] (hereinafter called “the Works”) and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   i) Letter of Acceptance;
   ii) Notice to proceed with the works;
   iii) Contractor’s Tender;
   iv) Contract Data;
   v) Conditions of contract (including Special Conditions of Contract);
   vi) Specifications;
   vii) Drawings;
   viii) Bill of Quantities; and
   ix) Any other document listed in the Contract Data as forming part of the contract.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:
Signed, Sealed and Delivered by the said _____
_____

in the presence of:
Binding Signature of Employer _____
Binding Signature of Contractor _____

Contractor
Employer

SECTION 5:

CONDITIONS OF CONTRACT

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Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

A **Variation** is an instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor’s Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor .

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 Deleted

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the design of the Works, other than the Contractor's design; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;

(A) prevent loss or damage to physical property from occurring by taking appropriate measures or

(B) insure against such loss or damage

12. Contractor's risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances , in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data :

(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;

(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and

(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payments is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of an insurance shall not be made without the approval of the Employer.

13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:

14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data

15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works

16.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer:

18.1 The Contractor shall submit Specification and drawings showing the proposed Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the design of Temporary Works

18.3 The Employer’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of third parties to the design of the temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.

24.2 Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.

24.3 Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

29.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer’s notice.

32. Uncorrected defects

32.1 If the Contractor has not corrected a Defect within the time specified in the Employer’s notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him

(a) Increase or decrease of any item of work included in the Bill of Quantities (BOQ);
(b) Omit any item of work;
(c) Change the character or quality or kind of any item of work;
(d) Change the levels, lines, positions and dimensions of any part of the work;

(e) Execute additional items of work of any kind necessary for the completion of the works; and

(f) Change in any specified sequence, methods or timing of construction of any part of the work.

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and the officer issuing oral instructions shall confirm it in writing with in 15 days, failing which the work shall be carried out as though there is no variation. In case variation is approved, it shall be accompanied by BOQ, failing which the contractor shall be responsible for deviation, if any. Further, approval of the Board has to be obtained for the variation exceeding 5%.

35. Payments for Variations

35.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

35.2 For quantities in excess of 125% of the tendered quantity of an item as given in the BOQ, the Contractor shall be paid at the rate entered in or derived from in the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

35.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rate for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract

35.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 35.1 or 35.2 or 35.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

35.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer’s own forecast of the effects of the Variation on the Contractor's costs.

35.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no

quotation shall be given and the Variation shall be treated as a Compensation Event.

35.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within 60 days of submission of bill. The Contractor shall be liable to pay liquidated damages for shortfall in progress. For Progress beyond the agreed programme, payment is subject to availability of the grants.

37.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.
(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
(e) The effect on the Contractor of any of the Employer’s Risks.
(f) The Employer unreasonably delays issuing a Certificate of Completion.
(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law. Amount put to tender is exclusive of GST and the Rates quoted shall be exclusive of GST.

40. Price Adjustment:

40.1 Contract price shall be adjusted for increase or decrease in rates and prices of materials, fuels and lubricants in accordance with the following principles and procedures and as per formulae given in the Contract Data.

(a) The price Adjustment shall apply for the work done from the date of commencement up to the end of original period of completion or extensions granted by the Employer and shall not apply to work carried out beyond the stipulated period of completion for reasons attributable to the Contractor;

(b) Price Adjustment shall be admissible from the date of opening of tenders (original or extended)

(c) The price adjustment shall be determined during each quarter from the formulae given in Contract Data.

(d) Following expressions and meanings are assigned to the work done during the quarter:

R = Total value of work done during the quarter. It would include the amount of secured advance for materials paid for (if any) during the quarter, less the amount of the secured advance recovered during the quarter. It will exclude value for works executed under variations for which Price Adjustments {if any) will be worked out separately based on the terms mutually agreed. It will also exclude the value of work done during the quarter which was programmed to be done prior to this quarter as per the work schedule in the agreement.

40.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 The Employer shall make payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an unconditional bank guarantee in a form acceptable to the Employer issued by a Nationalized/Scheduled Bank in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

42.2 The Contractor is to use the advance payment only to pay for Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Employer.

42.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuation of the work done, variations, price adjustments, compensation events or liquidated damages.

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

44.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

49.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer;

(b) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(c) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

(d) the Contractor does not maintain a security which is required;

(e) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(f) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph : “corrupt practice” means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. “Fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.”

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause 49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

51.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor’s default.

52. Release from performance

52.1 If the Contract is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made

F. Special Conditions of Contract

1. Labour :

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form
and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labour regulations :

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

4. Arbitration (Clause 24)

4.1 The procedure for arbitration shall be as follows:

Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 The Contractor has to co-ordinate with the other concerned Contractors as already specified in Conditions of Contract for all such works as per the directions of Engineer in charge at no extra cost.

6 **Continuation of Work:**

6.1 In case of the depth of a contractor after executing the agreement / commencement of the work, his legal heir, if any eligible registered contractor and willing, can execute and complete the work at the accepted tender rates irrespective of the cost of the work

7. FURTHER THE FOLLOWING CONDITIONS WILL ALSO BECOME PART OF THE AGREEMENT WHICH MAY PLEASE BE NOTED.

a. Rates quoted by the contractor / firm are inclusive of all taxes and duties but excluding GST.
b. The contractor / firm should mandatorily pay by themselves the necessary Entry Tax & other applicable taxes without fail.
c. Materials purchased with regards to work contract, the Board will not issue e-Sugam numbers.
d. The Contractor shall use tertiary treated water from BWSSB wherever available for Construction, Hydro testing at the prevailing rates of BWSSB.
e. The Supply of pipes and other materials shall be initially for only 50% of the quantity of BOQ is considered and further supply will be as per the recommendations of the Engineer In-charge based on the requirement.
f. All required permissions/ROW issues from all concerned departments shall be obtained from the contractor and Board Engineers will assist for the same.
g. No Variation work will be executed by the firm unless approval is conveyed from the Competent Authority.
h. One designated qualified safety officer/Engineer shall be deployed at site from the firm.
i. Jurisdiction of Courts/Arbitration: The sitting of arbitration shall be held at Bangalore only and nowhere else. Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.
j. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore City only and the parties agree and clearly understand that the courts/tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place.
k. The Parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees

submitted by the contractor at Bangalore for the execution of the contract at Bangalore.

l. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place or conditions during the execution of the contract.
m. Contractor shall be fully responsible in the event of death of employee/workman during the execution of the work and liable to pay adequate compensation to the dependents of employee/workman as per law.
n. On his/their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.
o. If death of any employees occurs during execution of work due to negligence of contractor, the contract will be liable for termination.
p. In the event of such termination, the employer may consider blacklisting of firm after due notice.
q. However, for the above package the firm has to provide **01 Nos of 5+1 seated Mahindra Scorpio AC Vehicle** with Driver, Consumables, Insurance tax etc till defect liability period. And handover the vehicle to the designated officers of the Board after completion of the project and also to provide the latest version **2Nos computer systems.**
r. In case of any death or accident the contract will be cancelled after following due process.
s. GIS survey is required and contractor needs to resurvey the entire pipeline stretch before starting the work.
t. The Board will be entitled to claim exemplary damages from the contractor in case of death of any work man / employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.
u. The Hard Rock obtained during execution, will not be auctioned by Board (Because of the restriction in stocking of hard rock in site and safety issues). However **Rs.70.00 per cum** of Hard Rock will be recovered from the firm in Running Bills.

Annexure:

LIST OF ORGANIZATIONS WHO ARE CONSIDERED AS APPOINTING AUTHORITY FOR APPOINTMENT OF ARBITRATORS

Deleted as per Order No. LAW-LAC/198/2024 Dt:16.11.2024.

SECTION 6:

CONTRACT DATA

CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract: Clause Reference

- The Schedule of Operating and Maintenance Manuals [48]
- The Methodology and Program of Construction [25]
- Site Investigation Reports [14]
- The Schedule of Key and Critical Equipment to be deployed on the work as per agreed program of construction. [25]

The Employer is : **Bangalore Water Supply & Sewerage Board**
Name: *Represented by Chief Engineer (Kaveri-O&M)*
[1.1]

Address: **Bangalore Water Supply & Sewerage Board**
8th floor, Cauvery Bhavan
K.G.Road, Bangalore -560009

Name of authorized Representative: **Executive Engineer(Kaveri-O&M)-1,**
BWSSB, T.K Halli

The name and identification number of the Contract is : **Tender for the work of extending additional raw water pipeline of 3200mm dia From Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake.**

The Works involves earth work excavation, providing and laying 3200mm dia MS water supply pipeline including specials, fixing of valves, construction of Valve Chambers etc.,

The start date shall be the date of issue of notice to proceed with the work. [1.1]

The Intended Completion Date for the whole of the Works is ***18 Months*** with the following milestones [17, 26]
Milestone dates: [41]

	Physical works to be completed	Period from the date of issue of Notice to proceed with the work
Milestone 1	a) Providing and Laying of M S pipeline – 0.5Kms.	Six Months for the date of Commencement.
Mile stone	a)Providing and Laying	Twelve Months for the date of

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2	MS pipeline – 1.5Km and other allied works	agreement.
Mile stone 3	a) Hydro testing of the entire Pipeline. b) 100% completion of 2.5Km and commissioning of all the works	Eighteen Months for the date of agreement.

The Site Possession Date is: 15 days [21]
The Site is located in T.K.Halli area and is defined in drawings. [1.1]

Payment Terms.

The employer will make the payment to the items of pipelines on the following terms

For MS Pipelines

75% of the contract price	After supply of MS pipes & proper stocking of pipes to site of work
20% of the contract price	After Laying and jointing of MS Pipes.
2.5% of the contract price	After completion of Hydraulic testing of MS pipe.
2.5% of the contract price	After Successful Commissioning of MS pipe.

Valves

75% of the contract price	After supply of Valves to site of work
20% of the contract price	After fixing in pipeline.
5% of the contract price	After successful completion of work

Steel Reinforcement for RCC Works:

80% of the contract price	After supply of Steel & proper stocking of Steel to site of work.
20% of the contract price	After Steel Bending and binding at site of work

The Defects Liability Period is **365**days [31]

Insurance requirements are as under: [13]

Type of Cover		Minimum Cover for Insurance
(i)	Works and of Plant and materials	The sum stated in the Agreement plus 20%
(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party	Rs. 20.00 Lakhs

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	(b) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka

Price Adjustment Formula [40]

R =Value of work as defined in Clause 40.1 of Conditions of Contract.

Adjustment for cement component

(i) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula.

$V_c = 0.85 \times P_c/100 \times R \times (C_i - C_o)/C_o$, Where

V_c = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for cement

C_o = The all India average wholesale price index for Ordinary Portland Cement for the quarter preceding the date of opening of Bids as published by the office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

C_i = The all India average wholesale price index for Ordinary Portland Cement for the quarter under consideration as published by office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

P_c = Percentage of cement component of the work

Note: *Index for all types of cement shall be considered from Cement –Group provided in the web site www.eaindustry.nic.in.*

Adjustment for steel reinforcement component

(ii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_s/100 \times R \times (S_i - S_o)/S_o$

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for steel (**MS -Long Products**) for the quarter preceding the date of opening of Bids as published by the office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

S_i = The all India average wholesale price index for steel (**MS-Long Products**) for the quarter under consideration as published by office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

P_s = Percentage of steel reinforcement component of the work

Note: For the application of this clause, index of **MS-Long Products** has been chosen to represent steel group for general construction.

Adjustment for MS pipe component

(iii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_{ms}/100 \times R \times (S_i - S_o)/S_o$

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for Steel (Pipes, tubes and Poles) for the quarter preceding the date of opening of Bids as published by the office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

S_i = The all India average wholesale price index for Steel (Pipes, tubes and Poles) for the quarter under consideration as published by office of economic advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

P_{ms} = Percentage of MS pipe component of the work

Adjustment for labour component

(iv) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$V_L = 0.85 \times P_l/100 \times R \times (L_i - L_o)/L_o$ Where,

V_L = increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local labour.

L_o = the average consumer price index for industrial workers for Bangalore centre for the quarter preceding the date of opening of Bids as published by Labour Bureau, Ministry of Labour, Government of India.

L_i = The average consumer price index for industrial workers for Bangalore centre for the quarter under consideration as published by Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

Adjustment for Plant and machinery spares component

(v) Price adjustment for increase or decrease in the cost of plant and machinery spares procured by the contractor shall be paid in accordance with the following formula:

$V_p = 0.85 \times P_p/100 \times R \times (P_i-P_o)/P_o$, Where

V_p = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for Plants and machinery spares.

P_o = The all India average wholesale price index for Heavy machinery and parts for the quarters preceding the date of opening of bids as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

P_i = The all India average wholesale price index for Heavy machinery and parts for the quarter under consideration as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi

P_p = Percentage of Plant and Machinery Spares component of the work.

Note: For the application of this Clause index of Heavy machinery and Parts has been chosen to represent the Plant and Machinery Spares Group.

Adjustment for other materials

(vi) Price adjustment for increase or decrease in the cost of other materials other than cement, steel, bitumen and fuel and lubricants procured by the contractor shall be paid in accordance with the following formula:

$V_M = 0.85 \times P_M/100 \times R \times (M_i-M_o)/ M_o$, Where

V_M = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for LOCAL materials other than cement, steel, bitumen and fuel and lubricants

M_o = The all India average wholesale price index for all commodities for the quarters preceding the date of opening of bids as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

M_i = The all India average wholesale price index for all commodities for the quarter under consideration as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi

P_M = Percentage of other material component (other than cement, steel, bitumen and fuel and lubricants) of the work.

The following percentages will govern the price adjustment for the entire contract:

1.	Cement – P_c	**2%**

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2.	Steel Reinforcement – P_s	**1%**
3.	MS Pipe – P_{ms}	**45%**
4.	Labour – P_l	**40%**
5	Plant and Machinery-P_p	**10%**
6	Others-P_M	**2%**
	Total	**100%**

The liquidated damages for the whole of the works are
Rs. ***0.1%*** per day of the contract value and that for the milestones is as under:

For Mile stone 1: 0.1% per day of the contract value Rs.17,75,60,000/- *
For Mile stone 2: 0.1%per day of the contract value Rs.39,00,00,000 /- *
For Mile stone 3: 0.1% per day of the contract value Rs.37,97,70,000/- *

The maximum amount of liquidated damages for the whole of the works is ten percent of final contract price. [41]

The amounts of the advance payment are: [42]

Nature of Advance	Amount (Rs.)	Conditions to be fulfilled
1. Mobilization	5% of the Contract price	On submission of un-conditional Bank Guarantee. (to be drawn before end of 30 days)

Repayment of advance payment for mobilization: [42]

The advance loan shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 15 percent of the Contract Price or 3 months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 7.5 percent of the amounts of all Interim Payment Certificates until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clauses 17 and 26.

The date by which “as-built” drawings (in scale **1:1000**) in 2 sets are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be. [48]

The date by which Operating and Maintenance Manuals are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be. [48]
The amount to be withheld for failing to supply “as built” drawings or supply of Operation and Maintenance Manuals by the date required is Rs.2,00,000/-
[48]

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The following events shall also be fundamental breach of the contract : [49.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be ***50*** percent. [50.1]

SECTION 7:

TECHNICAL SPECIFICATIONS

SECTION 7:

TECHNICAL SPECIFICATIONS

I GENERAL

1.1 Scope of Work.

The scope of work under this Contract includes the following:

1.1.1 Providing and Laying of 3200mm dia MS pipeline including construction of valve cistern etc.,

1.1.2 Earthwork in all kinds of soil, hard rock. The pipeline is to be laid from Shiva Balancing Reservoir (SBR) to V Stage pipeline at SBR Pipe Intake located in T.K.Halli area.

1.1.3 Fixing and connecting all pipelines fixtures like valves, bends, tees and other specials as specified in the construction drawings, construction all appurtenant structures such as pipe supports, valve chambers, thrust blocks, etc.,

1.1.4 Backfilling the trenches, restoring and making good all surfaces which are damaged during excavation.

1.1.5 Dismantling and reconstruction of structures such as culverts, storm water drains, roads etc., and utility lines such as water supply pipe lines, sewer lines coming in the way of the pipeline alignment.

1.1.6 Testing and commissioning of the pipe line after laying in segments and complete system.

1.1.7 Maintenance of all the pipelines for 12 months after commissioning. During this period, the contractor has to set right the defect of any kind in the manufacture, laying and jointing of all the pipelines and in the other works in this scope of tender.

1.1.8 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

1.1.9 The alignment of the pipeline and other typical details of pipe bedding, valve chambers, thrust blocks, pipe supports, and the general arrangement are furnished in Drawings. Further details shall be furnished in the construction drawings during the construction stage if found necessary.

1.2 Construction Methodology

1.2.1 Tenderer shall submit the detailed construction methodology along the clear programme of works while submitting the tender. The methodology shall include the safety measures to be adopted in the execution of work. Tenderer shall express in detail the methodology for addressing the Social & Environment factors during the execution of work.

1.3 Site Order Book

1.3.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the Contractor. After compliance with the instruction, the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer shall retain the original copy of the Site Order Book, while the Contractor shall retain the duplicate one.

1.4 Quarry Materials

1.4.1 The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, muram, etc., and to make his own arrangements for collection and transportation of the materials irrespective of the leads and lifts required. The quarry thus identified by the Contractor should have proper license from the Government of Karnataka. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications and shall be subject to the approval of the Engineer. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account.

1.4.2 **Royalties:** The Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent “Amendment to the Karnataka Minor Minerals Concession Rules - 1969” as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached.

1.5 Inspection and testing

1.5.1 Inspection of Material to be procured

Inspection and certification of all materials used on the works such as MS Pipes and Specials , Valves, Cement, Size Stones, Sand aggregate, Lead, Rubber gaskets etc., for conformity with specifications of BIS. If insisted, inspection of materials at the manufacture place shall be arranged by the contractor at his cost including the travelling and accommodation of the inspecting officer.

1.5.2 **Inspection and certification of the various components of works.**

Construction of MS pipeline with all fixtures, construction of Valve Chamber including back filling of trench in layers with compaction as specified to ensure that all components of works are carried out as per specification and to required standards.

Inspection & Certification of Hydraulic Test on Completed pipe line in reaches and as a whole network as specified shall be carried out. The hydraulic testing of the pipelines is to be certified by the Quality assurance zone of the Board.

1.6 Technical Specifications

1.6.1 Engineer shall have the right to modify/alter the Particular Specifications and/or Standard Specifications at any time which promise to confer equal or better quality than the standard specified in the tender document. Such modification or alteration shall be acceptable to the Contractor subject to no additional financial burden to either the Contractor or the Employer.

1.7 Storage of Materials and Plant

1.7.1 The Contractor shall provide appropriate storage facilities for materials like cement, steel, aggregates, consumable supplies, equipment, mechanical and electrical items, etc., and shall take all safety and security measures against theft and deterioration in quality, at his own cost.

1.8 Procurement of Materials:

1.8.1 CEMENT:

The Contractor shall use only 43 grade cement conforming to IS 8112 / 89 with latest amendments with ISI mark. The Contractor should furnish the manufacturer test certificate for the above brand of cement for having manufactured the cement as per relevant BIS and guarantee certificate before using the cement.

1.8.2 STEEL:

The Contractor shall procure the steel from VISL / SAIL / VSP / TISCO and manufacturers' test certificate is to be produced.

1.8.3. DI PIPES, VALVES AND OTHERS

Sl.No.	Description	Make
	DI Pipes	Electrosteel, Lanco Kalahasti, Jindal SAW
	DI Specials	Electrosteel, Kiswok,
	Sluice Valves Conforming to IS 14846/2000	KIRLOSKAR, IVI, DURGA, JUPITER, AVK, Magwen, hawle,DVD
	Butterfly valves – Conforming to IS 13095 / 1991	KIRLOSKAR, IVI, DURGA, JUPITER, AVK, Magwen, hawle,DVD
	Kinetic Air Valves	KIRLOSKAR, IVI, DURGA, JUPITER, AVK, Magwen, hawle,DVD
	Bolts, Nuts and Washers	GKW, TEXSO MAKE, T.V.S. UNBRAKO
	DMA Meter	Siemens, ABB, Chrone Marshal

The above branded makes are preferred. Board can specify any make among the above brands and rates quoted shall have provision for supply any make

specified among the list. If contractor wish to procure material from any other reputed manufactures, prior approval of the Board is required and can be obtained by requesting the Board along with the credential of such manufacture and standards of the material intended for procurement.

1.9 Equivalency of Standards and be procured, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.10 Sign Board

1.10.1 The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description of the Project, (iv) the amount of the Contract Price ; and (v) the starting and completion dates.

1.11 Samples and Tests

1.11.1 The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contract. Without limiting the generality of the foregoing, the Contractor shall either

(i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and/or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, provided the correctness of the equipments are ensured or

(ii) arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer up to 5% of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

1.11.2 The Contractor shall, within 14 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a detailed description of the arrangements for conducting the quality control programme during execution of the Works, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control programme is not adequate to ensure the quality of the Works, the Contractor shall produce a revised programme which will be adequate to ensure satisfactory quality control.

1.12 Protection of Utilities

1.12.1 The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer. In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

II EARTH WORK:

2.1 GENERAL:

2.1.1 The earth work excavation for laying of pipe shall be carried out. The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required in the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc. Before commencing the earth work, the Contractor shall carry out detailed survey of the proposed alignment, prepare construction drawings showing the longitudinal section of the ground profile, locations of valves and other appurtenances and submit to the Employer for approval.

2.2 CLASSIFICATION OF EXCAVATION

All materials involved in excavation shall be classified in three categories as follows:

2.2.1 **Ordinary soil:** This includes excavation in all types of soil including soil containing gravels, murrums, loose boulders, viz., ordinary gravely soil, hard gravely soil, wet soil, stiff slushy soil, chettu soil and calcareous strata, but exclusive of disintegrated rock, soft rock/shale;

2.2.2 **Soil Containing Disintegrated Rock, Soft Rock and Soft Shale:** This category includes excavation in soil containing disintegrated rock, soft rock or soft shale which can be cut by shovel and no hand or mechanical chiseling is required.

2.2.3 **Medium Hard Rock:** This category includes excavation in lime stone, sand stone, hard shale and schist fissured rock, without resorting to blasting.

2.2.4 **Hard Rock:** This category includes excavation in hard rock requiring hand or mechanical chiseling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiseling, wedging, the site of work shall be inspected by the engineer and the decision of the Engineer shall be final and binding on the Contractor.

2.3 LIMITATION OF EXCAVATION

2.3.1 The trench for laying DI pipes shall have minimum width as per standards stipulated or as directed by the Engineer-in-charge. A minimum earth cover of 1.0 m shall be maintained above the pipe top, unless otherwise specified or shown in the alignment drawings.

2.3.2 The Contractor shall be responsible to ensure that the widths and depths of the trenches do not exceed the limits shown in the construction drawings. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Contractor on account of this.

2.4 TRAIL PITS

2.4.1 Trial pits may be dug by the Contractor, without being directed to do so, along the alignment as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of under ground obstructions or soil conditions.

2.5 SLIPS AND SLIDES

2.5.1 The Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost.

2.6 STOCKING OF EXCAVATED MATERIALS

2.6.1 The excavated material shall be stacked on the sides of the trench wherever possible. Wherever it is not possible to stock on the sides of the trench, contractor has to find the place nearby for stocking the excavated material and cart the materials to & fro. Rate for this shall be included in the earthwork itself and no extra rate will be paid for this.

2.6.2 Surplus earth is to be disposed off to a place identified by the contractor approved by the engineer. There is a item for this work and will be paid accordingly.

2.7 Safety measures

The Contractor shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.
2. Red danger lights which can be easily visible from dusk to dawn placed at an interval of 20 m.
3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequate safe wooden plank / board or steel plate over the trenches to facilitate crossing by the public residing on either side of the trench.
5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorized intrusions.

2.8 Progress of Excavation of pipe trenches

The Contractor shall adjust excavation of trenches in such lengths that the pipes can be laid in such exposed portion of the trench within 2 days.

2.9 Shoring and Bracing

The Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at the Contractor’s request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

All sheathing, shoring and bracing which are left in place under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

2.10 EXCAVATION

2.10.1 Excavation in Rock

Excavation in rock shall be carried out to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus minimum working space on either side as given in drawing. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 50 m in advance of the pipe length proposed to be laid.

2.10.2 Excavation for Valve Chambers and Other Appurtenant Structures

The Contractor shall excavate as required for all structures with foundations to firm, undisturbed earth up to the level of the under side of the structure. If the excavation is in rock, the Contractor shall excavate all rock at least to the minimum limits shown on the standard details for trenches and to the grade of the bottom of inlets, junction chambers or other structures as required. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built. The Contractor shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

2.11 Contractor's Responsibility

The Contractor shall be responsible for the adequate pumping, drainage and bailing out water from the excavated trench. In case of failure to make such provisions or any other provisions which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item.

2.12 Works Included in Excavation

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

1. Provision of side space or additional space in the trench/pit for working and/or accommodating sheathing, shoring, bracing, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to protect the excavation where required or where such work is recommended by the Engineer.
3. Protection of excavations.
4. Providing adequate safety measures.
5. Additional work in connection with overhead wires and poles.
6. Excavation for Socket hallows.
7. Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work.

2.13 Measurement and Payment for Excavation

2.13.1 For Excavation

The measurement for excavation shall be considering the allowable widths, depths with allowed side slopes (if any) for different classes of soils as per approved classification. The measurement for excavation shall be based on "neat line" dimensions as specified in the drawing or Specifications, for different types of soils and depth of excavation. The total volume of excavation shall be computed as a square bottomed trench of width equal to the outer diameter of the pipe, with minimum working space as given in the drawing, added to it, length up to the length of the trench being measured. The depth of trench being average depth taken at 30 m intervals, between the level of bottom of trench and the original surface of the ground. The length of the trench shall be measured as per the actual length of pipes and fittings / specials laid at work site. However depth shall be measured at closure intervals at vulnerable places. The volume of excavation for structures like valve chambers, thrust blocks and anchor blocks etc., shall be computed and measured for payment as per the bottom area of the particular structure on outer periphery multiplied by the average depth between the level of the finished bottom of the structure and the original surface of the ground. The quantity shall be measured in cubic meters correct to two decimal places. The method of measurement for excavation in different classes of soils shall be as follows:

2.13.2 In Ordinary Soil and Soil Mixed with Disintegrated Rock and Soft Rock / Shale

In this category of soils, the excavation quantity shall be computed as specified above.

2.13.3 In Hard rock

In case of hard rock requiring chipping or chiseling, measurements shall be taken prior to and after chiseling and the volume of rock excavation shall be measured based on this difference. The excavation in rock shall be paid on stack measurements with a deduction of 40% in volume for voids.

2.13.4 For Excavation in Combination of Ordinary Soil, Disintegrated Rock, Soft Rock/Shale and Hard Rock/Schist

Wherever the excavation is undertaken in combination of ordinary soil, disintegrated rock, soft rock /shale and hard rock, the hard rock part shall be measured and paid, the soil part shall be measured and paid for the total measurable excavated quantity deducting the quantity measured for the hard rock. The total computed volume of excavation shall be equal to the sum of the computed volumes for each category of excavation undertaken.

2.14 Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such

utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer.

In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

III BEDDING.

3.1. Bedding for the pipe

Bedding shall be provided all along the stretch of the pipe line, which differs based on the area through which the pipe line passes. However, the type of bedding to be provided shall be as decided by the Engineer.

3.2 Earth Bedding

The pipes shall be placed on the natural, undisturbed earth bedding, which has been carefully shaped to fit the lower part of the pipe for a width of at least 50 % of its external diameter. The trench shall be excavated to an extra breadth and depth, wherever weld joints are coming. Filling and removing earth or similar materials beneath the pipe to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum.

3.3 Gravel Bedding

Wherever rock is met with, it shall be removed up to 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel. The granular material shall be filled in the trench up to the level of ¼ the outer diameter of the pipe line, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

3.4 Measurement for bedding:

The Contractor shall include the cost of earth bedding required for the pipeline in the tendered rate for pipe laying, for providing gravel bedding. The surplus quantity of excavated earth shall be disposed off. The quantity shall be measured in cubic meter correct to two decimal points.

IV BACK FILLING

4.1 General

The Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer's approval. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS: 3114-1994 and Clause 4.11 of IS 12288-1987.

4.2 Method of Backfilling

Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship.

4.2.1 Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimise future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

4.2.2 Backfilling in trenches shall be done as pipe laying progresses, with the permission of the Engineer, after the pipe or conduit is properly bedded, jointed and inspected and all measurements for the location of Y-Junctions, tees, etc., are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. However the joints shall be left open for inspection during testing, which shall be backfilled after successful completion of testing, after obtaining permission from the Engineer. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure. For the purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:

i. Zone A : From bottom of trench to the centre line of pipe,
ii. Zone B : From the level of centre line of pipe to a level of 300 mm above the top of pipe,
iii. Zone C : From a level of 300 mm above the top of pipe to the top of trench.

4.2.3 Backfilling in the trenches and around structures shall be carried out in horizontal layers of uniform thickness of not more than 150 mm when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling with water. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

4.2.4 After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. Even in this case the backfill material shall be placed in uniform horizontal layers of not more than 150 mm thickness. Small pebbles of size less than

50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. The backfill material shall be tamped with mechanical tamping equipment, after moistening the backfill by sprinkling with water to obtain maximum compaction (min 95% proctor density).

4.2.5 Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment.

4.2.6 If the trench is subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure.

4.2.7 Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

4.2.8 If from the excavated soil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits is required to be placed for backfill, on approval of the Engineer backfilling of trenches where the excavation is in the rock shall be with the surplus soft soil, with all lead and lift.

4.3 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread at places shown by the Engineer, with all lead and lift from the site of work, for which payment shall be made as per the quoted rates. No surplus or excess material shall be disposed in a stream / channel or in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer.

V DUCTILE IRON PIPELINE

5.1 Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile Iron pipeline and fittings including associated civil works required for the same.

5.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS:8329 Centrifugally Cast (Spun) ductile Iron Pressure pipes for water, gas and sewage.

IS:638 Sheet rubber jointing and rubber insertion jointing.

IS:1387 General requirements for supply of metallurgical materials**.**

IS:1500 Methods for Brinell Hardness test for metallic materials.

IS:9523 Ductile Iron fittings for pressure pipes for water, gas and sewage.

IS:12820 Dimentional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.

ISO:4179 Ductile iron pipes for pressure and nonpressure – Centrifugal cement mortar lining – General requirements.

ISO:2531 Ductile iron pipes, fittings and accessories for pressure pipe lines.

IS:5382 Specification for Rubber Sealing rings for Gas mains, water mains and sewers.

AWWA C600 Installation of ductile iron water mains and their appuratenances.

IS:11906 Recommendations for cement-mortor lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

IS:3764 Excavation work – code of safety.

IS:12288 Code of practice for use & laying of Ductile iron pipes.

IS:460 Test sieves – Part I

IS:8112 Specification for 43 Grade Ordinary Portland Cement.

BS 3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.

BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.

ISO 81790 For zinc coating.

5.3. Manufacture of pipe

DI pipes and fittings (Class K7 & K9) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.
All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer.
If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal.

Contractor
Employer

The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one.
In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring.
In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the centre line. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

a). Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 - 2000 and IS: 9523 - 2000.

b). Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Pipe of standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS: 8329/IS: 9523. Each pipe shall be of uniform thickness throughout its length.
The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

5.4 Testing

(a) **Mechanical tests**
Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS: 8329/IS: 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The tests results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS: 8329/IS: 9523.

(b) Brinell Hardness Test
For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

(c) **Retests**
If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the tests results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

(d) Hydrostatic Test
For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/IS9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with a 700 g hammer for conformation

of satisfactory sound. They shall with stand the pressure test without showing any leakage, sweating or other defect of any kind. The hydrostatic test shall be conducted before surface coating and lining.
During manufacture, tests on pipes shall be carried out in accordance with **clause 1.2.8 of this Technical specification** by the Third party inspecting agency.

5.5 Jointing of pipes

(a) General

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

(b) Spigot and Socket joints

These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.
The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

(c) Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

(d) Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.
Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

5.6 Specials

Standard DI fitting shall be in accordance with IS:9523. Wherever standard DI specials are not available, they shall be manufactured and tested as per requirements with the approval of Engineer.

5.7 Coatings

i). General

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

ii). Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.
Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

iii). Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer. The curing shall commence immediately after completion of the mortar lining, shall not be later than 8 hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of minimum 14 days.
Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.
Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

5.8. Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a). Internal diameter of pipe.
b). Class of pipe.
c). Date of manufacture and
d). Name of manufacture or his registered trade-mark or both.

5.9. Carting & Handling.

Carting and handling of D.I. pipes and fittings shall be in accordance with the clause 3.4. of GSW pipes specifications.

5.10. Trenching.

Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of part-2 Earth work excavations clause 2.0 to 2.17.wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.

Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the pipe when laid in its correct position, shall, unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Side Clearance (mm)
350 to 600	200	300
> 600 to 800	200	350

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increase shall be approved by the Engineer.

All trenches deeper than 1.2 m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench if required. The Contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sides shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The Contractor shall erect temporary fencing around all open excavations and post warning signs in English and the local language. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The Contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m or as directed by Engineer. The opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes. inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required.

To protect persons from injury and to avoid damage to property, adequate barricades, construction signs. red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.

The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side .of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants. sluice valves, manholes covers etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Engineer may direct.

Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting e rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer ma direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipe line of water, gas, sewage etc.

5.11 Deleted

5.12 Laying of pipes and fittings.

Pipes and fittings shall be laid in accordance with IS 12288 and manufacturers instructions.

The pipeline shall be constructed in lengths with a separate full time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the Contract. Any subsequent changes to the programme shall be submitted to and approved by the Engineer before work to a different programme

is started. Excavation for the pipeline in anyone length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipes shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of ± 10mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineer.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipeline under construction to anyone gradient.

The Contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the requirements of this Specification. The Contractor shall obtain from manufacturers all special information regarding the handling of the pipes, joints and other fittings and he will be deemed to have made himself thoroughly conversant with all phases of pipe laying before commencing' the' works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progresses. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the Contractor shall plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. The plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas , sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering or aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2° for 600 mm and 800 mm, 3° for 300 mm, 350 and 450 mm diameter pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as per manufacturers' recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe: cutting machine shall be used.

The valve chamber frame and cover (Cast Iron and Fibre reinforced concrete) shall be as specified in Part 24. clause 24.3.11.

5.13 Thrust / Anchor Blocks.

Anchor blocks shall be provided at horizontal bends. vertical bends or/and at intervals on pipelines with gradients in excess of 1 in 6 as noted on the Drawings, and at other locations ordered by the Engineer. The anchorages shall be made from concrete and constructed to the dimensions shown on the Drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the Contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown.

5.14 Backfilling

Trenches shall be backfilled with approved selected excavated material only after the successful testing of the pipeline as directed by Engineer. Backfilling shall be in accordance with requirements specified hereafter and as shown on Drawings.

On completion of the pipe laying operations in any section, for a length of about 100 m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he IS satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall be taken during backfilling, not to injure or disturb the pipes,' joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material up to height of at least 300 mm over the top of the pipe except as may be necessary for tamping etc., during backfilling work.

The remaining portion of the trench shall be filled in with selected excavated material free from and topsoil, vegetation or boulders and clods of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95% of the maximum dry density as per Part 7 of 18:2720. The water contents of the soil shall be kept as near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The surface of the refilled excavations shall be left slightly higher than the adjacent ground and be maintained by the Contractor to a smooth even slope.

The Engineer shall, at all times. have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be so used.

If suitable material for refilling is not available from already excavated material the Contractor shall import material of approved quality as directed by the Engineer. Unless expressly specified in the Bill of Quantities. the Contractor shall include the above under backfilling rates.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval from the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during the works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200 mm thick after compaction. The method of compaction employed shall achieve not less than 90% maximum dry density as determined from IS 2720 : Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

5.15 Pipelines under existing roads.

The Contractor shall programme the Works to reduce disruption to road traffic to a minimum, and before any work commences in existing roads shall:

(a) Obtain the full permission and approval of all authorities concerned serving notices of intent to start work as may be necessary and observing all the local Laws and Regulations

(i) Submit details of his proposals, and obtain approval from the Engineer and local highway authority

(ii) Constructing of temporary diversion roads

The pipelines crossing roads shall be encased in M15 concrete as shown on the drawings.

Pipelines which are laid along a road shall be laid in trench. The bed and surround shall be previously specified but above this the trench shall be backfilled with crushed rock up to the underside of the road sub-base. Not more than 20 % of the crushed rock shall pass through a IS test sieve with 4.75 mm apertures and all material shall pass through a IS test sieve having an aperture of 40 mm. The backfill shall be compacted in layers having a maximum thickness of 200 mm and

the method of compaction used shall achieve not less than 95 % maximum dry density as determined from IS 2720: Part 7.

5.16 Cleaning of Pipes and fittings.

Pipelines shall be cleaned of all dirt, debris. dust or other deposits before hydraulic test to the satisfaction of Engineer. Cleaning with metal cleaning solution, acid, wire brushes, scrappers or sand paper shall not be permitted.

The section of the pipeline once cleaned shall not be entered into for any purpose later. Sufficient precaution shall be taken to prevent the ingress of any dirt, debris, or dust inside the section. Failing this the section shall be cleaned again at the discretion of the Engineer. When deemed necessary by the Engineer suitable closures shall be provided at the open end or the ends of the cleaned sections

In the case of above ground pipeline, the length of the section to be taken up for cleaning shall be decided in consultation with the Engineer from the point of view of ventilation etc.

In case of buried pipeline a section shall be taken up for cleaning after the work of back filling around and over the pipeline is completed and the spiders have been removed from inside with approval of Engineer.

Pipelines shall be cleaned through a foam swab. Swabbing shall be carried out successively between adjacent swabbing points. The foam swab shall comply with the following:

Pipeline over DN 300 - Swab dia = Pipe dia + 75mm

Quality of swab shall be hard - when restrictions in the main do not reduce the diameter of the pipeline to less than two thirds of the swab diameter

Quality of swab shall be soft - when restrictions in the main are in excess of the above but do not reduce the diameter of the pipeline to less than one half of the swab diameter.

The Contractor shall make necessary arrangements for equipment, fittings and water necessary for cleaning the pipeline. The Contractor shall submit proposals for swabbing, water storage and disposal arrangements to the Engineer for approval.

No separate payment will be made for the work of cleaning and providing closures. The rates quoted for the laying of pipes shall include the cost of cleaning also.

5.17 Hydraulic Testing

Pipelines and fittings shall be subjected to hydraulic pressure tests in the presence of the Engineer which shall comply with IS 12288 unless otherwise specified.

Testing shall be carried out in two stages;

(i) Test of sections as construction proceeds

(ii) A test of the whole of the pipeline on completion

The Contractor shall equip himself with all plant, equipment, fittings and water necessary for the hydraulic tests. The Contractor shall submit to the Engineer, well in advance of the time of tests, details of his proposals, including the supply of water either by tankers or boreholes. No connections from the existing pipelines will be allowed, nor will any connections to the pipeline and pipe work which would involve cutting, tapping or altering the Permanent Works be allowed.

Test gauges shall be of approved manufacture having dials at least 200 mm diameter. graduated such that the test pressure is at least 75 % of the full scale reading shall be used, If necessary different gauges shall be supplied for different pipeline sections. Two gauges shall be provided for the sole use of the Engineer and shall remain in Engineer's possession for the duration of the Contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as required by the Engineer.

The Contractor's arrangements for testing shall include a suitable means of quick installation and removal of the Engineer's gauges during testing.

5.18 Hydraulic Testing Pipelines

The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid, Jointed and backfilled to a depth sufficient to prevent floatation, but leaving the joints exposed which have not been tested, The sections to be tested shall be to the approval of the Engineer and shall not be longer than 2000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the Test on Completion,

In addition to the above requirements the Contractor shall perform a hydraulic test on the first 200 m length of pipeline to be laid under the contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes. Should the pipeline fail the test or the Contractor fails to undertake the test, all laying work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be

permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping .

The pressure shall then be slowly increased at a maximum rate of I bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall pass the test if the leakage is not more than 1.079 litres per mm diameter per kilometre per 24 hours for each 100m head of pressure applied and the full test pressure has been sustained for at least eight hours.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The Test on Completion shall be carried out after all the pipeline sections have been satisfactorily tested and the Joints between each section completed to provide a continuous test length between contract interfaces.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

5.18.1 Test pressures

Test pressures are to be measured in bars at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or

shown on the drawings pipeline test pressure shall be in accordance with the following:

DI pipe and fittings 10 bar

For testing of sections of pipeline containing air valve chambers the Contractor shall verify from manufacturer that the air valves are capable of operating under and sustaining the test pressure.

5.19 Chamber Markings

Details like valve type. size, cistern number shall be painted on all valve chambers as directed by Engineer. Where valve chambers are flush with the ground, suitable marker posts shall be provided adjacent to the chambers at a suitable location with all details approved by Engineer.

In case of the pipeline laid above ground details such as chainage, invert levels of pipe, saddle number, culvert number, anchor/thrust block number etc., shall be suitably painted either on the pipeline or the supporting structure in distinct colour.

5.20 Measurement and Payment

The measurement for pipes for items specified in Bill of Quantities shall be on running metres of net length along the centre line of the pipe excluding the length of specials and appurtenances. Payment for pipes shall be made in running metres after production of test certificates specified and directed by Engineer.

Payment for laying the pipes and specials shall be made after successful testing at site.

5.21 Location and Protection of Existing Public and Private Utilities.

Once permission to work has been obtained from the road authorities, and prior to excavation, the Contractor shall contact all utility companies and householders in roads where work is to take place and inform them of the nature of the work and its likely duration. Information should be obtained from utilities companies about the location of their utilities, preferably in the form of record drawings, and the Contractor should carry out utilities tracing using electronic equipment to verify the positions of utilities. Trial excavations should also be carried by hand to further confirm locations of utilities. The Engineer will only permit trench excavation to proceed when he is satisfied that adequate efforts have been made to establish the alignments and depths of existing utilities.

All underground utilities such as water pipes, gas pipes, drains, sewers, electricity and telephone cables exposed in excavations, shall be properly supported and protected by the Contractor to the satisfaction of the Engineer so as to avoid damage to the utility or to the Works as a result of collapse of the utility.

Similarly, poles carrying overhead electricity and telephone wires should be braced and supported where there is any likelihood of collapse as a result of excavation.

5.22 Valves

5.22.1 General

Valves shall be as per Internationally recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504.

Valves shall be double flanged type and the face shall be parallel to each other and flange face should be at right angles to the value centerline. Back side of value flanges shall be machined or spot faced for proper seating of the head and nut.

Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.

Valves of diameter 100 mm and above shall be provided with lifting eyes and shall have detachable bolted covers for inspection, cleaning and servicing.

Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position

The valve stem, thrust washers, screw, nuts and all other components exposed to water shall be of a corrosion resistant grade of stainless steel.

Valves shall be free from sharp projections.

5.22..2 Sluice Valves

Sluice valve shall conform to IS 780 and IS 2906 or relevant internationally recognized standards.

They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm

The gate face rings shall be screwed into the gate or alternatively securely pegged over the full circumference.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Materials of Construction:

Body of gate	Cast iron to IS: 210 Gr FG 200
Spindle	Stainless steel BS 970 gr 431 S29

Seat Rings	Stainless steel ASTMA 743 CF8
Back Seat Bush	Bronze; IS 318 Gr LTB2
Shoe & Channel Lining	Bronze; IS 318 Gr LTB2

Size of valves and pressure rating as per Bill of Quantities. Location of valves shall be as per contract drawings. The contractor shall provide test certificates for materials, strength and leakage shall be in accordance with BS 5150/ IS 750.

The design and locations of washouts are shown in drawings. Exact positioning shall be determined by the Engineer with regard to topography. With regard to washouts at least 3 m of the washout pipe work, inclusive of the isolating valve, measured from the center line of the pipeline shall be laid at the same time as the pipeline and suitably capped to prevent ingress of foreign material. The minimum gradient for the washout pipe work shall be 1 in 100, if not shown in Drawings.

5.22.3 Air valves

The air valve shall be capable of exhausting air form pipe work automatically when being filled. The air being released at a sufficiently high rate to prevent the restriction of the inflow rate. Similarly the valve shall be capable of ventilating pipe work automatically when being emptied, the air inflow rate being sufficiently high to prevent the development of a vacuum in the pipelines. The valve shall also automatically release air accumulating in pipe work during normal working conditions.

Air valve shall be of the double orifice type with a large orifice for air entry into the pipeline and smaller orifice for automatic release of air under normal working pressure. The valve shall be suitable for the maximum working pressure in the systems. All air valves shall be provided with isolating valve and flanged end connections.

Air valve shall be designed to prevent premature closure prior to all air having been discharged from the line. The orifice shall be positively sealed in the closed position but the float (ball) shall only be raised by the liquid and not by a mixture of air and liquid spray.

The seating shall be designed to prevent the floats sticking after long periods in the closed position.

Air valve shall comprise of cast iron body having faced and drilled flange at inlet and with two chambers each housing a ball. One chamber shall have small orifice and other a large orifice. Balls shall be of injection moulded plastic with high impact strength or any other suitable approved material.

Materials of Construction:

Body/cover	Cast Iron (IS 210 Gr FG 220)
Seat ring	Gun metal (IS 318 Gr II)
Float/Balls	Vulcanite

Valves shall be DN 200 and shall be PN16 pressure rating. Location of valves shall be as per contract drawings.

The contractor shall provide test certificates for materials and properties shall be in accordance with relevant standards.

Before carrying out pipeline pressure testing the contractor shall verify with the supplier of the air valves that the valves have the capacity to sustain the pipeline test pressures. In the event that they do not sustain the pressure the valves shall be removed and the stubs off the pipeline shall be blanked off before pressure testing the pipeline.

5.22.4 Nuts, Bolts and Washers

Unless otherwise specified, nuts, bolts and washers shall be galavanished and/or zinc electroplated conform to the requirements of IS 1364. Bolts shall be of sufficient length that at least one thread but not more than three threads shall show through the nut when in the fully tightened condition.

VI. ANCILLARY STRUCTURES

6.1 The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor.

6.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends as suggested, for effective transfer the hydrostatic thrust developed during the operation of the rising main. They shall be constructed at the locations shown in the alignment drawings, and are of the respective dimensions shown therein. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

6.3 Valve Chambers

RCC valve chambers shall be provided for all valves. These valve chambers are of different sizes suitable for air valves, scour valves & Control valves with RCC pre-cast slabs covering.

6.4 Structures for Crossing Canal/ Nallahs and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in

Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

6.5 Grade of concrete

6.5.1 Ordinary Concrete

In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades designated as M 7.5, M 10, M 15 and M 20. It can also be specified by volumetric mix as given in Table-4 below. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic meters in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for 'bulkage' shall be made as per IS: 2386 (Part III).

Ingredients required for ordinary concrete containing one bag of cement for different proportions of mix shall be as given in Table-4 below.

Table-4

Ingredients Required for Ordinary Concrete

Grade of Concrete*	Nominal Mix by volume Cement: Fine Aggregate: Coarse Aggregate**	Total quantity of dry in kg (max) by mass per 50 kg of cement (to be taken as the individual masses of fine and coarse aggregates)	Quantity of water in liters (max) per 50 kg of cement***
M 7.5	1:4:8	625	45
M 10	1:3:6	480	34
M 15	1:2:4	350	32
M 20	1:1.5:3	250	30

* In the designation of a concrete mix, letter 'M' refers to the mix and the number refers to the specified 28 days' works compressive strength of that mix on 150 mm cubes, expressed in N/ sq. mm.

** The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

*** The amount of water should be kept minimum required for proper workability. The quantity given in the column is not to be exceeded.

6.6 Strength Requirement of Concrete

Where Ordinary Portland Cement conforming to IS.269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table-5. Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in Table-5 shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests for concrete up to and including M 25, and 25 per cent higher for higher grades. Preliminary tests need not be made in case of 'ordinary concrete'.

Table-5

Strength Requirements

Grade of Concrete	Compressive test Strength on 150 mm cubes after testing in accordance with IS: 516 (N/sq.mm)	
	Minimum at 7 days	Minimum at 28 days
M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25

In all cases, the 28 days compressive strength specified in Table-5 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table-5, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

6.7 Use of Plums in Ordinary Concrete

Stone Plums shall not be used unless specified in the drawings. When stone plums are used, the size may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substances in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete-laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave portion upwards. The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums. The total volume of plums shall not exceed 15% of the volume of the finished concrete.

VI MILD STEEL PIPELINE

6.1 Scope

This specification covers the general requirements for fabrication, laying, testing and commissioning of longitudinal & circumferential welded mild steel SAW pipes above /below ground, including associated civil works required for the same.

6.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS 2062	Steel for general structural purposes
IS 808	Dimensions for hot rolled steel beam, column channel and angle sections
IS 814	Covered Electrodes for manual metal arc welding for carbon and carbon manganese steel
BS 5155	Specifications for butterfly valves
AWSS-5.1	Specification for mild steel covered arc welding electrodes
IS 3613	Acceptance tests for wire flux combination for submerged arc welding
AWS: A-5.17	Specification for Bare Mild Steel Electrodes and Fluxes for submerged arc welding
IS1367	Technical supply conditions for threaded steel fasteners.
IS2016	Plain washers
IS2074	Ready mixed paint, air dying, red oxide zinc chrome. Priming
IS1786	High yield strength deformed steel bars and wires for concrete reinforcement
IS432 (Part-1)	Mild steel & Medium Tensile bars and hard drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars
IS432 (Part 2)	Mild steel and Medium tensile steel bars and hard drawn steel wire for concrete reinforcement: Part 2 Hard drawn steel wire
IS 269	33 grade ordinary Portland cement
IS8112	Specification for 43 grade Ordinary Portland Cement
IS8041	Specification for Rapid hardening Portland cement

IS383	Specification for coarse and fine aggregate from natural source
IS12330	Specification for Sulphate Resisting Portland cement
IS 4353	Submerged arc welding of mild steel and low alloy steels recommendations
IS456	Code for practice for plain and reinforced concrete
IS800	Code of practice for general construction in steel
IS816	Code of practice for use of Metal arc Welding for General construction
IS817	Code of practice for Training and Testing of Metal Arc Welders
IS1182	Recommended practice for Radiographic examination of Fusion Welded Butt joints in steel plates
IS2595	Code of Practice for Radiographic Testing
IS3658	Code of practice for Liquid Penetrant Flew Detection
IS5334	Code of practice for Magnetic Particle Flaw Detection of welds
ASTM E 94	Recommended Practice for Radiographic Testing
ASTM E 109	Dry powder Magnetic Particle Inspection
ASTM E 138	Wet magnetic Particle Inspection
ASTM E 165	Liquid Penetrant Inspection
IS 3600	Methods of testing of Fusion Welded joints and Weld metal in steel
IS 483	Recommended practice for Radiographic inspection of fusion welded butt joints in steel pipes
IS 3589	Specification for seamless or Electrically welded pipes for water, Gas and Sewage
IS 6631	Steel pipes for Hydraulic purposes
IS 7343	Code of practice for ultrasonic testing for ferrous Welded Pipes and Tubular Products
IS 2598	Safety code for Industrial Radiographic Practice
IS 5822	Code of Practice for laying of electrically welded steel pipes for water supply
IS 1566	Hard drawn steel wire fabric for concrete reinforcement
IS 6419	Welding rods and bare electrodes for glass shielded are welding of structural steel

IS 1974	Bare wire electrodes for submerged arc welding
IS 7307	Approval tests for welding procedures
IS 7310	Approval tests for welders working to approved welding procedures
IS 2720	Methods of test for soils
IS 780	Specification for Sluice valves for water work purposes. (50 to 300mm size)
IS 2906	Specification for sluice valves for water work purposes (350 to 1200mm size)
IS 1916	Steel cylinder pipe with concrete lining and coating
IS 7322	Specials for steel cylinder reinforced concrete pipes
IS 11906	Recommended for cement mortar lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

6.3 Materials

Steel plates – The steel plates for pipes fittings, specials and stiffeners shall be of mild steel conforming to IS2062 Grade B, with no negative tolerances on the plate thickness

Pipe fittings, specials and stiffeners shall be of mild steel conforming to IS 2062 Grade B steel with no negative tolerances on the plate thickness.

Cement – Ordinary Portland cement conforming to IS 269.

Aggregate – The aggregate shall confirm to IS 383

Water – The water used in preparation of concrete mix shall conform to the requirements of mixing water specified in IS : 456

Welding consumables – such as electrodes, filler rods and wires shall conform to IS 814, IS 3613, IS 6419 and IS 7280

When requested by the Engineers, the contractor shall provide test sample of the materials to be used in the works for testing. The cost of such tests shall be borne by the contractor and shall be included in his item rates.

6.4 Inspection

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the contractor of his responsibility to furnish materials and performed work in accordance with this specification.

The contractor will notify the engineer, in advance of the procurement of materials and fabrication thereof, in order that the employer may arrange for mill and shop inspection. The engineer may reject any or all materials or work that does not meet with any of the requirements of this specification. The contractor shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the engineer.

The Engineer shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of the work under this specification.

The contractor shall supply free of cost required specimen of materials for testing by the employer at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of engineer.

The contractor shall provide 2(two) sets of accurate “GO” and ‘No Go’ ring gauges to measure the diameter of pipes, specials and fitting for the use of the Engineer at no extra cost.

6.4.1 Some of manufactures of MS pipe are detailed below:

1)	**M.S. PIPES**
1.	M/s. Steel Authority of India Ltd., No.8, BISL Building, J.C. Road, Bangalore-560 002.
2.	M/s. Welspun, Trade World, ‘B’ Wing, 9th Floor, Kamala Mills Compound, Senapati Bepat Marg, Lower Parel, Mumbai- 400 013,
3.	M/s. Swastik Pipes Ltd., No.41, K.M. Delhi, Rohtak Road, District Jhajjar (Haryana).
4.	M/s. Asian Mills Pvt.Ltd., 104, Sarkar-III Opp. Old High Court, Near Income Tax Circle, Ahmedabad-380 014.
5.	M/s. Surya Engineers, Plot No. G20/8, MIDC Area, Ahmadnagar, Maharashtra.
6.	M/s. PSL Holdings, 22, Vaijavoor Village, Malai Vaiyavoor P.O., Mahuranthakam Taluk, Kancheepuram Dist – 603 308.
7.	M/s. Maharashtra Seamless Ltd., Pipenagar, Village Subeli, N.H.17, B.K.G. Road, Taluk Rona, District Raigad, Maharashtra – 402 126.
8.	M/s. Mukut Tanks & Vessels, Surindra House, Safaid Pool, M.V. Road, Sakinaka, Mumbai-400 072.
9.	M/s. Taher Ali Industries & Projects (P) Ltd., Survey No.23/A, Agapally Village, Ibrahimpatnam, Sagar Road, R.R. District, Andhra Pradesh.
10.	M/s. Surindra Engineering Co.,Ltd., Surindra House, P.O.Box 8939, Mumbai.
11	M/s. Pratibha Pipes & Structural Pvt., Ltd., Shrikant Chamber,

.	Phase II, 5th Floor, Near R.K. Studio, Sion-Trombay Road, Chembur, Mumbai-71.
12.	M/s. Mukat Pipes Ltd., D-46, M.I.D.C., Baramathi, Pune-413 133.
13.	M/s. Subash Pipes Ltd., 279-280, Mysore Bannur Road, Ranganathpura Village, P.O. Rangasamudra District, Mysore.

6.5 Manufactures of Pipes and Specials

Plate Welded Pipes

All pipes and specials shall be manufactured out of mild steel plates conforming to IS 2062 Grade B steel. The procedure of cutting plates to size, rolling of plates, post bending, tack welding, internal and external welding, facing should be such that it results in pipes of required diameter and thickness conforming to IS 3589, or equivalent or better international standards.

6.3.2 THICKNESS AND DIAMETER

The wall thickness and diameter of pipes shall be as shown below except as otherwise specified.

Internal diameter (mm)	Outside diameter (mm)	Nominal wall thickness (mm)
3200 ID	3240	20

6.3.3 LENGTH OF THE PIPE

Steel pipes of lengths ranging from 7.5 to 12.5 meters shall be fabricated to suit to Contractor's methodology of works. The permissible variation in pipe lengths shall be in accordance with IS 3589.

6.3.4 PIPE ENDS

Pipes shall have bevelled ends suitable for welding in accordance with IS 3589.

6.3.5 Demonstration

The Contractor shall make necessary arrangements to demonstrate at the pipe manufacturing mill individual items of work before commencement of works and during the works at intervals specified and as directed by the Engineer. No payment shall be made in this regard.

The works under demonstration shall include but not limited to the following:

(i) Manufacture of pipe and specials
(ii) Chemical and mechanical testing of pipes and specials
(iii) Machine and manual welding to qualify 'Welding Procedures'
(iv) External coating

(v) Internal epoxy lining
(vi) Hydraulic testing after internal epoxy lining at 20bar pressure

6.5.1 General

The pipes shall be truly cylindrical, and straight in axis. The ends shall be accurately cut and prepared for field welding the external circumference of the pipe pieces which are to be fixed adjacent to the flange adapter with fixed outer diameter shall not deviate from theoretical one by more than 2mm. to obtain this accuracy the pipe shall be rolled several times, if necessary, as pipe pieces should be truly cylindrical. The external longitudinal welding of this pipe shall be ground smooth flush with surface to the satisfaction of the Engineer, for a length of 200 mm from the ends of the pipe. No extra cost shall be charged by the contractor for this grinding work.

Minor repair by welding or otherwise shall be permitted at the discretion of the engineer, but such repairs shall be done only after obtaining the prior permission from the Engineer. Any pipe or part thereof which develops injurious defects during welding or other operations shall be rejected.

6.5.2 Fabrication Yard

This fabrication yard meant for fabrication of pipes, specials etc shall also be equipped with facilities for testing, guniting, painting etc. For completing the work under the present contract within the contract period, the fabrication yard shall be equipped with adequate numbers of equipment and plant including:

- Plate bending machine for rolling of pipe drums
- Automatic welding machines (suitable for circumferential as well as longitudinal welding)
- Hydraulic welding machines
- Traveling gantry or crane of capacity 10 tonnes or above
- Mobile cranes for loading/unloading of plates, pipes etc. 15 tonnes capacity each
- Lathe for machining of the flange rings, plates etc.
- Equipment for sand blasting, cement mortar lining, and facilities for bitumen wrapping

The fabrication yard shall have adequate area, and shall also have stacking areas for the stacking of plates, pipes and fittings. The contractor shall make his own arrangements for any area required.

6.5.3 Demonstration

Contractor shall demonstrate the works in this contract at fabrication yard before commencement of works and during the works at intervals specified and as directed by the Engineer. No payment shall be made in this regard.

The works under demonstration shall include but not limited to the following:

- Manufacture of pipe and specials
- Machine and manual welding to qualify 'Welding Procedures'
- Hydraulic testing
- Pipe handling procedures

6.5.4 Cutting plates to size

The plate provided shall be utilized so as to minimize wastage and so as to make the pipe as far as possible with one longitudinal joint. Plate sizes shall generally suitable for fabrication of 1.5 m long shells (minimum), to be made up to pipes of 6.0 m to 12 m lengths to suit contractor's proposed working methods.

Before cutting, all the edges of the plates shall be cleaned by brushing/grinding both the sides.

After the plates are cut, the edges shall be made smooth and even by polishing with an electrical or pneumatic grinder to remove all inequalities. Care shall be taken to see that the cut edges of the plate are perfectly straight. Jigs to be used for this purpose shall depend upon the types of cutting machine used. The plates cut to the required shapes shall be checked for the correctness before they are rolled into pipe drums. If any correction is required, the contractor shall do the same by re-cutting, if necessary. If any plate or flat is found to be warped, to have corrugations, the defects shall be removed by putting the plate or flat into a roller press and rectified. Laminated or heavily corroded plate shall not be used in manufacturing of the pipe.

The ends of the finished pipe in the factory shall necessarily have bevel ends conforming to IS 3589 to facilitate field welded joints.

6.5.5 Rolling of Plates

The plates cut to the exact size shall be put into a rolling machine to form a pipe of the required diameter. The contractor shall adjust the rolling machine so as to give a uniform curvature to the pipe throughout its circumference. The curvature obtained shall be checked by the contractor's foremen during the process of rolling and if proper curvature is not obtained at any place including the ends, the rolling operation shall be repeated at this stage or even after the longitudinal welding of the drum where directed. Heating of plates to obtain the desired curvatures shall not be permitted.

6.5.6 Tracking the Drums

The rolled drums shall be kept on an assembly platform for tracking, care being taken to ensure that the tacked drums have either faces at right angles to the axis of the pipe. A gap of 2 mm to 4 mm shall be maintained while tacking the drum, where the manual arc welding, is permitted. However, where the welding is to be done by automatic welding machine, there is no need to maintain such gap. To achieve this objective, clamp spiders, tightening rings and or any other approved gadgets shall be used. Each drum, before being taken to the assembly platform, shall be numbered on the inside with oil paint, stating the plate thickness as well.

6.5.7 Assembly of Drums into Pipes

The tacked drums shall then be transported to an assembly platform where they shall be welded together to form suitable pipe-lengths. Plate shall be bent in the maximum possible width to reduce the number of circumferential joints. The number of longitudinal joints shall be as per IS 3589.

The longitudinal joints shall be staggered at 90 degrees. The drums shall be tacked together as above. The assembly shall be truly cylindrical and without any kinks. The faces shall be at right angles to the axis of the cylinder. A suitable arrangement for testing the correctness of the pipe shall be provided by the contractor at the assembly platform.

6.5.8 Specials

Specials shall be fabricated to the dimensions shown on drawings. Specials, such as tees, Y-pieces, bends, tapers, etc. shall necessarily be in steel and shall be in accordance with IS 7322/BS 534/AWWA C208 and ASME standards and tested and laid in the same manner as the pipes.

Standard fittings shall be used wherever possible in preference to fabricated fittings. Standard fittings shall be manufactured in accordance with standards above. Where fabricated fittings are supplied with approval of Engineers they shall be fully workshop fabricated and tested in accordance with above standards.

Tee and branches on steel pipelines must be reinforced by welding collars around the base of the branch and in the case of large diameter branches, increasing the main pipe wall thickness or making use of crotch plates. Unless shown otherwise on the drawings branches shall comply with the requirement of the following table:

Fitting Description Pipe work O.D. (mm)	Main Pipe wall Thickness (mm)	Branch Pipe Wall Thickness (mm)	Collar Details (mm)
324 off 1999	14/12	5.0	150 Wide x 14 to 25 Thick
324 off 1999-1549 Taper	14/12	5.0	150 Wide x 14 to 25 Thick
324 off 1999-Level Invert Tee	14/12	5.0	150 Wide x 14 to 25 Thick
324 off 1647	11/12	5.0	150 Wide x 14 to 25 Thick
324 off 1241	8/10	5.0	150 Wide x 14 to 25 Thick

The fittings shall be designed and, if considered necessary by the Engineer, fabricated by a specialist contractor and the design calculations and drawings shall be submitted to the Engineer for approval. For oval shaped collars the width given in the above table shall be at the narrowest point. All other fittings, tees, branches, crosses and bends are to be designed by the fabricator.

Steel specials shall have the same chemical and mechanical properties and shall be compatible in all respects with the pipes with which they are to be used. The marking of pipes and fittings shall be as specified.

6.5.9 Electrodes

The contractors shall use appropriate type and size of electrodes with suitable flux covering depending on the thickness of plate and the type of joint. They shall also use standard current and voltage required for the machine in use as per manufacturers directions. Welding electrodes shall conform to IS 814 and IS 4353. electrodes from reputed manufacturers like Advani Oerlikon, D& H, Philips etc. shall be used with the approval of Engineer. India made or equivalent foreign made electrodes of the approved quality shall be used. The contractor shall provide suitable equipment and ovens to keep the electrodes dry at the desired baking temperature.

6.5.10 Welding

Upon receipt of the order and prior to the start of fabrication, the contractor shall submit to the Engineer for his approval the 'Welding Procedure Method Statement' he intends to use in the shop work. At the same time the procedure for the field welding must be submitted to the Engineer for his approval.

All components of pipe shell, either straight or bent etc shall be welded by use of automatic arc welding machine by submerged arc process with alternating current. The strength of the joint shall be at least equal to that of the parent material. Manual welding shall be adopted only when machine welding is not possible.

The contractor shall use electrodes of approved make and size, the size depending on the thickness of the plate and the type of joint. Standard current and arc voltage required for the machine shall be used with necessary modifications as may be found necessary after experimental welding. For this purpose, samples of welded joints shall be prepared and tested in the presence of the Engineer for qualifying the welded procedure Method statement. Only approved welding procedures of the Engineer shall be obtained.

All the shop and the field welding conform to IS 4353, IS 9595, IS 816.

All longitudinal and circumferential joints shall be Single-V or Double-V butt joints with or without backing plates. After completing the welding joints of pipes or plates from one side, and before the welding on the other side, the joints shall be back chipped/ gouged and ground to remove irregular penetration till the even surface is exposed. Gouging shall be restored to when the plate thickness is above 6mm.

All circumference welds involving plates of unequal thickness shall be so kept that the inside surface of plates match to provide stream lined joints without alteration in the internal diameter.

The welding shall be the best workmanship free from weld defects. In order to maintain a good standard in welding, welders shall be tested by the contractor before they are entrusted with the job. Qualification standard for welding procedures, welders and welding operators shall confirm IS 7307 and IS : 7310 (latest). Only those who pass the test shall be allowed to work on the job. Periodical tests as regards their competence shall also be taken at suitable intervals and those found incompetent shall be removed from the job. If an incomplete welder has already welded some pipes, all welding done by him previously shall be fully checked by X-ray in addition to the regular X-ray inspections. The defects if any, shall be rectified to the satisfaction of the Engineer. All such check tests and rectification of defects shall be entirely at the cost of the contractor. No pipes or steel sections shall be erected unless the work of the welders concerned has been proved to be satisfactory and qualified. Site welds shall be done by welders qualified for the various welding positions as per applicable IS codes and standards.

A record shall be maintained showing the names of welders and operators who have worked in each individual joint. Manual arc welding shall preferably be carried out by a pair of welders so that by, observing proper sequence, distortion can be avoided. A joint entrusted to a particular individual or a pair shall be as far as possible, completed by them in all respects, including sealing run. No helper or other unauthorized person shall be permitted to do any welding whatsoever.

The weldment should not become brittle or sensitive to blows and there should be no loss of toughness due to welding or heat treatment. The material after welding and heat treatment shall match with the base metal properties including original ductility. The weld should in no point be less than the nominal thickness of plate a slight reinforcement as per IS code shall be maintained on all weld joints. Final welding of closure gaps should be carried out within a temperature range of average air temperature ± 8^{o} C.

Where required by the Contractors working methods the pipes shall have cable holes /entries installed in the fabrication shop; they shall comprise a hole in the pipe with a reinforcing plate welded to the pipe with a tapped hole in it large enough to allow the passage of the cables and other paraphernalia necessary for welding the pipes. A screwed plug shall be provided to close the hole.

6.5.11 Testing of Weld Coupons

Test pieces shall be provided by the contractors for both longitudinal and circumferential welded and joins at the positions pointed out by the Engineer the sample so taken out shall then be cut to the exact shape and dimensions and machined as described in relevant standards before testing for chemicals and mechanical properties.

The entire cost of the tests including provision of test samples, machining the test pieces, transport to and from the laboratory and testing them in a laboratory, payment of all testing fees, cleaning and painting etc. shall be borne by the

contractors. The tests shall be carried out in a government or semi government institute approved by the Engineer. This shall be arranged by the contractor with the approval of Engineer. the testing laboratory shall have instruments/ equipments which are having calibration requirements traceable to National or International standards.

The following tests shall be carried out:

Mechanical Tests

The test plates shall be subjected to all mechanical tests as per the approved method statement, or as otherwise reasonably directed by the Engineer. Test shall be carried out in the accordance with relevant standards. The tests shall include determination of yield strength, tensile strength, elongation and bend tests. Tensile test shall be carried out in accordance with IS 1894. One test plate shall be provided for from each lot of 100 lengths.

If a test specimen shows defective machining or develops flaws not associated with welding, it may be discarded and another specimen submitted. The welded joint shall exhibit mechanical properties not lower than those specified for highest 2062 Grade B.

Guided bend test shall be in accordance with IS 3589/IS 3600. One bend test shall be carried out from each lot of 50 lengths. The test shall comply with the requirements specified in IS 3589/ IS 3600.

Field Joints

The field welded joints shall be tested in accordance with the proce3dure laid down in IS3600. One test plate shall be taken for every 10 joints and shall be subjected to mechanical and chemical tests as specified above.

6.5.12 Re-tests

If the results of tests of any lot do not conform to the requirements specified, retests of two additional specimens from the same lot shall be made,. Each of which conform to the required specifications, in case of failure of one or both, gouging and repairing shall be carried out to the particular lot of joints from which the samples have been taken as directed by Engineer before the lot can be accepted. The rectification process shall also have adequate tests plates and they shall be tested for complaints with the IS codes/standards.

In case both the samples yield satisfactory results in the retest described above, gouging and repairing will be required to the carried out on the joint which has failed in the initial test only.

All charges in connection with retesting of the welded sample including machine, testing etc. shall be borne by the contractor.

6.5.13 Radiograph of Welded Joints

As soon as practicable, after welding is done, every longitudinal and circumferential welded length minimum 10% (ten percent) length of the weld at random for each pipe shall be radio graphed, to detect welding defects as per the requirement of IS4853 and as directed by Engineers. This 10% sampling will be at random but ensured 100% coverage of junctions of longitudinal and circumferential joints. If the results of such radiography fail to conform to the requirements, the contractor shall carry out 100% radiography test for the pipe as directed at the contractors cost to the satisfaction of the Engineer.

The weld repels or welds surface irregularities and slag etc., on both inside and outside shall be removed by any suitable mechanical process to a degree such that result in radiographic contact due to any remaining irregularities cannot mark or be confused with that of objectionable defect. The radiograph shall be made in strict accordance with the latest requirements and as per the latest and most efficient technique either with X-Ray or gamma ray equipment. The safety requirement during radiography shall be in accordance with IS 2598.

The radiographs are to be marked in such a way that the corresponding portion of the welded seam and the welder can be readily identified. All radiographs will be reviewed by the Engineers to identify the defects and determine those, which requires rectification. Defects that are not acceptable shall be removed by chipping; grinding or flame gouging to sound metal and resulting cavities shall be welded. After rectification, the joint is to be radio graphed again to prove the quality of the repair. The radiograph will be judged as acceptable or un acceptable by the Engineer based on the latest standards prescribed by the relevant Indian standard specification.

All X-rays shall be taken with equipment and by personal of the Contractor. Films shall be developed within 24 hours of exposure and be ready in accessible at all times for inspection by the Engineer. the contractor shall provide for the use of the Engineer suitable X-Ray viewing equipment. X-Ray films shall be properly maintained by the contractor. A complete set of radio graphs and records as described in IS : 2595, for each job shall be retained by the contractor and shall be handed over to the BWSSB on completion of the Contract. All films shall be identified by the number and chart prepared indicating location of any work associated with the pipe erection and such inspection shall be performed by the radiographer at the discretion of the Engineer.

Radio graphic inspection of welded joints:

All welded joints to be radio graphed shall be examined in accordance with

IS 2595 - Code of practice for Radiographic Testing
IS4853 - Recommended Practice for Radiographic examination of fusion welded Butt-joints in steel pipe
IS1182 - Recommended Practice for Radiographic examination of fusion welded Butt-joints in steel pipe
IS2598 - Safety Code for Industrial Radiographic Practice

Radiographer performing radiographs shall be qualified in accordance with SNT-TC-1A . Supplement and appendices “Recommended Practice for Non-destructive Testing Personal Qualification and Certification” published by the American Society for Non-Destructive testing as applicable for technique and methods used.

Final acceptance of Radiographs shall be based on the ability to see the prescribed pentameter image and the specified hole.

Sections of welds that are shown by Radiography to have any of the following types of imperfections shall be judged un-accepectable and shall be repaired.

- Any type of crack, or zone of incomplete fusion or penetration
- Any elongated slag inclusion which has length greater than 6 mm
- Any group of slag inclusion in line that have an aggregate length greater than thickness in a length of 12 times thickness, except when the distance between the successive imperfection exceeds 6 L where L is the length of the longest imperfection in the group.
- Rounded indication in excess of that specified by the acceptance standards given earlier.

6.5.14 Tolerances

Tolerances of the plate thickness shall be ± 3%. Minimum width of the plate shall be 1.5m.

A tolerance for straight pipes shall be in accordance with IS 3589 or as amended below.

Finished pipe sections shall be truly straight with walls parallel to the axis of the pipe and shall not be out of the alignment by more than 0.2% of the total length.

The outside circumference of the pipe shall not vary by more than 0.5 per cent.

Outside diameter of the pipe shall not vary by more than plus or minus 0.5 per cent.

The permissible tolerance for specials for diameter, arm length and angular deviation shall be in accordance with IS 7322/BS 534.

Whenever any dent, i.e., a significant alteration of the curvature of the pipe shell is noticed, the depth of the dent shall be measured between the lowest point of the dent and the pipe shell curvature line. All dents exceeding 2 per cent of the outer diameter of the pipe shall be removed by cutting out a cylindrical portion of the pipe and replacing the same by an undamaged piece of the pipe. the Engineer may permit insert patching if the diameter of the patch is less than 25 percent of the nominal diameter of the pipe. Repairs by hammering with or without heating shall not be permitted. Any damage to the coating shall also be carefully examined and rectified.

6.5.15 Pipe Testing in Fabrication Yard

A hydraulic test shall be carried out at the fabrication shop for each pipe length fabricated, in the presence of and to the satisfaction of the Engineer. All pipes and

specials shall be subjected to hydraulic test at the fabrication yard after fabrication, but before application of protective coatings.

Prior to testing, the pipe shall be inspected thoroughly and all the apparent defects in welding such as slag, prosperity etc. shall be repaired by gouging and re-welding.

Each pipe shall be filled with water slowly and the pressure increased uniformly until the required test pressure is reached. The test pressure shall be 18 bars for pipes and specials with 10mm thick MS plate.

The pipe tested shall be given a serial number which shall be painted with details such as pipe number, shell thickness, diameter, length etc. as directed by Engineer. It shall be entered in the register to be maintained by the contractor. The register shall be maintained in suitable format giving the following information for each shell tested:

- Serial No.
- Pipe No.
- Date of test
- Specification and thickness of steel
- Weight of pipe shell tested
- Maximum test pressure
- Details of test performance
- Details of radiographic examination of welds
- Name of Engineer’s representative witnessing tests.
- A copy of these details shall be furnished to the Engineer.

For indicating the pressure inside the pipe an accurate pressure gauge of approved make duly tested and calibrated for the accuracy of readings shall be mounted on one of the closures which close the pipe ends.

The pressure shall be applied gradually by approved means and shall be maintained foe at least 10 minutes or till the inspection of all welded joints is done during which time the pipe shall be hammered throughout its length with sharp blows, by means of a 1 kg hand hammer.

The pipe shall withstand the test without showing any sign of weakness, leakage, oozing or sweating. If any leakage or sweating is observed in the welded joints, the same shall be repaired by gouging and re-welding after dewatering the pipe. The repaired shall be re-tested to conform to the specified pressure.

If any leak or sweating is observed in pipe shell the pipe under test shall be rejected temporarily. The Contractor shall stack such rejected pipes separately in his yard. The Engineer shall inspect the same as shall determine the nature of repairs to be carried thereon and shall then decide as to how and where they shall be used. No payment shall be made of handling or carrying out repairs, but, payment for, fabrication and shop hydraulic testing of the pipe shall be released only after acceptance of the pipe with necessary repairs and subsequent testing etc. are carried out by the Contractor to the satisfaction of the Engineer. The Engineer shall be supplied with two copies of the results of all the tests carried out.

No pipe shall be transported out of the fabrication yard to the site unless they have hydraulically tested except permitted by the Engineer in writing to do so.

6.5.16 Marking

All pipes and specials shall bear the following markings. The marking shall be on the side which will be the inside of the pipe after bending. The marking operation shall be conducted with full size rulers and templates. Only blunt nose punches should be used.

The plates used for fabrication of pipes shall be laid out in such a way that when the shells are completed one set of original identification markings for the material will be plainly visible. In case these markings are unavoidably cut out, they shall be accurately transferred by the contractor to a location where these markings will be visible on the completed work.

After the hydraulic tests on the specials the direction of the flow shall be stamped in a prominent manner.

- Outside Diameter (mm)
- Length of pipe/angle of the bend (m/degrees)
- Plate thickness (mm)
- Approximate of weight of the pipe/special (tons)

6.6 Joints

(i) General

Unless detailed otherwise, all pipes and fittings shall have welded joints as detailed in Drawings. Where shown on the Drawings, flanged joints or collar sleeve joints shall be provided.

(ii) Welded Joints

The use of butt welded joints for joining pipes shall be in accordance with clause 6.6.10 and end preparation shall be in accordance with IS 3589

(iii) Sleeve collar joints

The use of sleeve collars shall generally be limited to the jointing of pipes at tie-ins. The thickness of the external steel sleeve collar shall be not less than that of the pipe itself and the length a minimum of 300 mm. the sleeve shall be joined to the pipe with an internal full depth structural weld and external sealing welds to allow the joint to be gas tested. A gas testing hole shall be made at each end of the sleeve and for the purpose of gas testing joints.

(iv) Flanged Joints

Flanged shall comply with IS 7322/BS4504. The nominal pressure rating shall be at least equal to the highest pressure rating of the pipes of fittings to which they are attached, but with a minimum PN 16. The contractor shall fabricate flanges meeting the requirements of the pipe sizes under this contract or otherwise to suit

the abutting valves or other connections, if they are not readily available. Flanges shall be provided with all necessary nuts, bolts, washers and gaskets, as specified herein. The Contractor shall also supply in suitable containers sufficient graphite grease for application to the bolt threads when joints are made.

(v) Slip of Type Couplings

Slip on Type Couplings shall include the following coupling:

- Straight flexible couplings
- Stepped flexible couplings
- Flange adopters
- Dismantling joints

Slip on Type Couplings shall be from the Viking Johnson System manufactured by the Victaulic Company or form approved suppliers whose fittings meet the same Specifications.

The preparation of pipe ends for slip-on Type Couplings shall be in accordance with the requirements of and the tolerances specified by the joint manufacturer. Couplings shall be installed fully in accordance with the manufacturer's recommendations.

Slip on Type Couplings shall be protected if buried with Densomastic and Densotape wrapping or similar approved material applied in accordance with the manufacturers recommendations. Flexible joints shall be harnessed or tied where shown on the Drawings. Flexible couplings and flange adaptors shall be supplied with transit protection.

6.7 Storage

Pipes and fittings shall be stored raised off the ground and shall be carefully supported, cushioned and wedged. Special care shall be taken to ensure the steel pipe is cradle and supported in a manner that prevents any distortion of the pipes.

All gaskets, nuts and bolts flange adaptors and other similar items shall be stored in the dry conditions, raised off the ground in sheds or covered areas.

Where items required special storage requirements, the method of storage shall be to the approval of Engineer and in accordance with manufactures requirements.

Storage areas shall be set out to facilitate unloading, loading and checking off materials.

All pipe materials shall be inspected when deposited in the storage area any defects or damage shall be noted and reported to the Engineer. the pipe material shall only be repaired or replace with the Engineers approval.

End covers and other protection shall noty be removed until in corporation of the pipes or fitting into the works.

6.8 Transportation and Handling

All pipes and specials fabricated in the yard and temporarily stacked in the factory shall be transported carefully to the site of laying after internal cleaning.

Any vehicles on which pipes are transported shall have a body of such length that the pipes do not overhang. Last pipes shall be placed on cradles and the loads properly secured during transit.

Additional precautions shall be taken to avoid deformation of flexible pipes. To maintain their circular cross-section internal struts shall be fitted in the pipes. Details of the proposed strutting system shall be submitted to the Engineer to the approval and if required by the Engineer, the method of strutting shall be demonstrated and tested on site.

The pipes and specials shall be handled in such a manner as not to distort their circularity or cause any damage to their coating. Wide non-abrasive or other approved slings shall be used and all hooks and other metal devices shall be well padded. Hooks engaged on the corner wall surface at pipe ends shall not be used. Steadying ropes shall be employed.

The positions of lifting slings shall ensure that stresses and tendency towards deformation in the pipes are kept to a minimum.

Pipe handling equipment shall be maintained in good condition and any equipment, which is in the opinion of the Engineer, may cause damage to the pipes shall be discarded.

Under no circumstances shall pipes be dropped, be allowed to strike one another, be rolled freely or dragged along the ground.

No valves shall be lifted by the spindle.

Fabricated materials such as man-hole covers, appurtenances, bolts, nuts, flanges, saddles, collars, bypass arrangements etc., shall be transported to the site of laying from the fabrication yard according to needs of the laying operations only.

6.9 Pipeline Construction

6.9.1 General

Laying/Erection of fabricated pipe lengths shall be carried out by the Contractor who shall equip himself, at his cost with all necessary tools, machinery, labour etc., required for the purpose. The pipeline shall be constructed in lengths with a separate full time gang working on each length.

Except for routine welding of joints, no other work shall be done in the absence of Engineer.

The components of the sections of the pipeline such as plates, and pedestals have been so designed that the centers of the plates and pedestals shall coincide at the mean temperature of the locality. For this reason, all works such as fixing flanges, plates etc. in true alignment, and in correct position and tack welding pipes shall be done at the mean temperature. For ascertaining the temperature, the contractor

shall provide mercury cups and fix them to the pipe shell from outside and shall also provide thermometers of the required type and range. No extra payment shall be made for this.

6.9.2 Laying Programme

The contractor shall submit a detailed bar chart for manufacturing and laying of the pipeline, which shall be subject to the Engineer's approval. In preparing this bar chart, the contractor shall plan his activities such that the laying of pipes shall closely follow the manufacturing schedule and no pipes shall remain in factory or at site for a period more than two months.

Together with the chart he shall submit a methodology describing how he will carry out this work within the contractual period and the required resources in terms of construction equipment and other facilities that he shall utilize to complete the works.

6.9.3 Contractor to Resurvey the Pipeline Route

While setting up the site the contractor shall undertake survey of the pipeline route and compare this with the survey supplied at the time of tender and a joint record. Levels are to be taken at 30 m intervals and at any sharp changes in level. Where practical the chainage points shall coincide with those original surveys. Not less than 14 days before commencement of pipe laying the Contractor shall supply the Engineer, any discrepancies, if observed, with two hard copies and one computer disk copy of the survey.

The format of the survey shall be identical to the longitudinal sections which formed part of the tender documents. The Engineer shall supply the contractor a copy of the longitudinal section and the contractor is to use this to produce new drawing. Details of all the benchmarks which were used in the original survey of that length of pipeline shall be supplied to the contractor by the Engineer.

The Engineer shall resolve any problem arising from discrepancies between the two surveys and supply the contractor with any revised Drawings that may be required.

6.10 Protective Coating:

After the pipe is subjected to hydrostatic test, 20 mm thick outside coating by gunniting in CM 1:3 over 50 X 50 weld mesh of 13 gauge and inside lining with cement mortar 1:1.5 shall be provided confirming to the specifications given in **IS 3589-2001** with its amendments.

6.10.1 Outside coating:

a. Materials:

i. Reinforcement:

All cage reinforcement used in the pipe shall confirm to IS 432 (Part I of Part II)-1982. Minimum reinforcement in the coating shall be three percent of the quantity of steel cylinder of minimum thickness given in Table 1 of IS 1916-1989. The reinforcement shall be wire mesh electrically welded or woven fabric and specially crimped of otherwise self furring to held the reinforcement 10 to 13 mm away from the surface on which it is applied. The wire mish shall weigh not less than 12.5 kg/sq.m. The reinforcement shall be free from loose mill scale, dirt or excessive rust. The clear cover to the reinforcement shall not be less than 12 mm for coating.

ii Cement:

Cement used for the inside lining and outside coating shall conform to IS 8112-1976 and as amended from time to time.

iii Aggregates:

Aggregates used for the outside coating and inside lining shall conform to IS 383-1970 and as amended from time to time. The minimum size of aggregate shall not exceed one-third the wall thickness of the pipe or 10 mm which ever is smaller.

iv. Water:

The water used in preparation of concrete mix shall conform to the IS 456.

v. Concrete:

Concrete used for outer coating shall conform to IS 456-2000. The concrete mix shall have a minimum cement content of 450 kg/m^3 and a minimum compressive strength of 21 N/mm^2 at 28 days. Compressive strength tests shall be conducted on 15 cm cubes in accordance with the relevant requirements of IS 456-2000 and Is 516-1959 and as amended from time to time.

6.10.1.1 Thickness of guniting:

The minimum thickness of guniting shall be as given below. For pipes up to300 mm inner clear diameter, minimum thickness of lining shall be 20 mm.

6.10.1.2 Preparation of steel surface:

At the time of application of the concrete or mortar, the surface of the pipe shall be clean. Loose rust, loose mill scale, dirt, debris, oil, grease and other detrimental materials shall be removed by manual, mechanical means or by sand or steel grit

blasting. The coating shall not commence before the expiry of three days after the completion of the lining unless otherwise it is established that the lining has attained a works cube strength of not less than 10 Mpa earlier than this period. During this entire period the lining shall be under curing. The coating shall be either vibrated or applied under pressure by rotary brushes.

After field welding of the joints, the exposed portions of the adjacent pipes shall be protected by placing wire fabric with tack welds and applying cement mortar by hand.

6.10.1.3 Curing:

After completion of concreting, the concrete or mortar shall be kept wet by any suitable means, such as immersion in water, covering by wet gunny bags, or by mechanical sprinklers, for a period of not less than 7 days. Non pressure steam curing also can be done provided the requirements of non-pressure steam curing are fulfilled.

6.11 Buried Pipelines

6.11.1 Trenching

Trenching includes all excavation which is carried out either by hand or by machine and shall be carried out in accordance with all general requirements of Part-5. In addition to those general requirements, the following requirements shall apply to pipelines:

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the when laid in its correct position, shall unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and the bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Site Clearance (mm)
600 to 1000	250	400

1050 to 2500	300	500

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increased shall be approved by the Engineer.

All trenches deeper than 1.2m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench of required. The contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sites shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The contractor shall erect temporary fencing around all open excavations and post warning science in English and the local languages. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m. the opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes, welding of pipes, inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

6.11.2 Bedding

The depth and type of bedding shall be as shown in the Drawings or as directed by the Engineer. Where rock or boulders are encountered, the trench shall be transmitted to a depth of at least 300 mm below the level at which the bottom of the barrel of the pipe is to be laid and filled to a like depth with sand as shown on the Drawings or as directed by the Engineer.

The class of bed and surround to be used are indicated below:

Class of bed and surround	Brief description of bedding material
Class A	Mass Concrete
Class N	Well Graded Sand
Class S	Granular material

Class S bed and surround shall be used on all pipes unless otherwise specified or shown on the Drawings.

The concrete to be used for Class A bedding and surround shall be M15 type. Class A bedding shall be used at all road crossings under the road and for a distance of 5 m back from the back edge of road or footpath and also where depth of overburden is more than 1.5 meters from crown of pipe

Class N bed material shall only be used where the pipe trench is founded in hard rock or otherwise directed by the Engineer. the sand shall be clean and well graded and free from topsoil, clay or vegetable matter and to the approval of the Engineer. if the sand supplied is unclean it shall be washed. In no case shall sand containing more than 3.5% by dry volume or 5% by wet volume of clay, loam or silt be accepted. Tests specified for determining silt in sand and organic impurities as described in IS 383 shall apply.

The graded granular bed material for use in Class S bedding and surround shall consist of durable gravel, crushed stone or disintegrated rock. Selected material excavated from the pipe trench may be used, provided it contains no topsoil, clay or vegetable matter and is to the approval of the Engineer and shall be supplied with the certification which gives details of its content of the granular material shall not exceed 0.5% and 0.06% by weight respectively.

Graded Material.

The Contractor’s method of grading the excavated material shall be to the approval of the Engineer. All Class S graded material shall pass through test sieves to IS 460 (Part 1) in the following proportions by mass :

Aperture Size	Percentage passing
50 mm	100%
37.5 mm	90 - 100%
20.0 mm	35 – 70%
14.0 mm	25 – 55%
10.0 mm	10 – 40%
5.0 mm	0 - 5%

6.11.2 Construction of Class A bed and Surrounds:

Class A bed and surround shall be constructed as indicated on the Drawings.

Before placing concrete the pipes shall be supported near each joint with a padding of compressive material on a precast concrete block. Concrete shall not be placed until the pipes have been jointed, inspected and tested. The concrete shall be placed to ensure full contact with the pipe barrel throughout its length.

The concrete shall be made discontinuous at flexible pipe joints by a diapraghm of fibre board or other compressible material of at least 20 mm thickness extending for the full area of the surround.

No concrete shall be placed around joints of a welded steel pipe until that length of pipe has passed a sectional hydraulic test.

6.11.3 Construction of Class S bed and Surrounds

Class S pipe bed and surround shall be constructed as indicated on the Drawings.

The granular material shall be evenly spread over the full width of the formation and lightly compacted to a level slightly higher than level corresponding to the underside of the pipe barrel to allow for settlement of the pipe to the correct level.

Following placement and jointing of the pipe further granular material shall be placed in the trench, special care being taken to fill under the sides of the pipes to ensure full contact with the barrel of the pipe.

Field joints which have not been tested shall be left exposed for a minimum length of 150 mm each side of the joint. The granular material shall then be placed and compacted evenly on both sides of the pipe to a depth of 300 mm above crown of the pipe.

Trench supports shall be withdrawn gradually in accordance with the progress of the fill with the provisions that such withdrawal shall not prejudice the safety of the works.

The contractor shall ensure that the material to the sides of the pipe is adequately compacted in layers having a maximum thickness of 150 mm and that the method of compaction used shall achieve not less than 95 % of the maximum dry density as determined from IS 2720: Part 7

After each section of the pipeline has passed the hydraulic test, the exposed joints shall be backfilled and compacted to the above specification.

The same general requirements shall apply to Class N bedding.

6.11.4 Pipe Laying

Pipe shall be laid in accordance with IS 5822 unless otherwise specified herein.

The pipeline shall be constructed in lengths with a separate full time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the contract. Any subsequent changes to the programme shall be submitted and approved by the Engineer before work to a different programme is started.. excavation for the pipeline in any one length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found

to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall not be properly padded with sufficient bags stuffed with sand or straw for protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipe shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of +- 10 mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineers.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in the position on each length of the pipe under construction to any one gradient.

The contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the\e requirements of this specification. The Contractor shall obtain from manufactures all special information regarding the handling of the pipes, joints, and other fittings and he will be deemed to have made him thoroughly conversant with all phases of pipe laying before commencing the works.

A “badger” or “bung” about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progress. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the contractor shall be plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. the plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

6.11.5 Level Control

The criterion for the level to which transmission main shall be laid such that the cover above the crown of the pipe to ground level shall be as specified in the drawings but in no case shall be less than 1200 mm unless otherwise directed by the Engineer.

6.11.6 Laying to Curves

Where pipes are to be laid to curves, the deflection at each joint shall not exceed one degree. For sharper curves specifically made bends shall be provided.

6.11.7 Lowering and Jointing

The pipe shall be lowered into the trenches such that no part of any shoring is disturbed or damaged and if necessary, additional temporary struts may be fixed during the lowering operations. Care shall be taken to ensure that the longitudinal joints of two consecutive pipes at each circumferential joint are staggered by 90 degree. While assembling the pipes, the ends shall have to be brought close enough to leave a uniform gap not exceeding 4 mm. there shall be no lateral displacement between the pipe faces to be joined. If necessary, spiders from inside and tightening rings from outside or other suitable equipment shall be used to bring the two ends in perfect contact and alignment. In no case shall hammering or longitudinal slitting be permitted. Jacking may be permitted for this purpose in particular circumstances and approval by the Engineer.

When the pipe is properly assembled firmly supported on wooden beams and wedges or by other approved means it shall be checked for correct line and level and tack welded. The tack welded circumferential joints shall then be welded fully.

On completion of the pipe jointing the external portion shall be coated with M15 concrete and the trench and the welding pits shall be cleaned. The welding pit shall be filled with approved bedding.

6.11.8 Floatation

The contractor shall take proper precautions against the risks of floatation and the flooding of the excavated works and shall make due allowances in his programme for any closure he considers necessary on account of monsoon.

Should any section of the pipeline be affected by floating in the course of works the entire work shall be removed and then reinstalled to the satisfaction of Engineer. The entire cost of laying it again to the correct line and level shall be to account of the Contractor.

6.11.9 Steel Props

In order to effectively provide cement mortar lining to the inside of the pipes and to avoid difficulties during the work, it is necessary that the roundness of the pipes is maintained circular till the lining work is taken up. To achieve the same, steel adjustable screw type props of screw or similar approved type consisting of minimum six legs(three props) shall be fixed inside the pipe and the diameter correctly set.

The design and drawings of the props that the contractor intends to use should be approved by the Engineer before starting the work. These props shall be fixed vertically at intervals as directed by the Engineer. The props should be kept in position at least for three days after the encasing of the pipe in that section is

completed or until refilling is done to the full height of fill over the pipe in case the pipes are not encased. The props shall be removed only after obtaining permission from the Engineer.

6.12 Internal Cement Mortar Lining

All pipes and fittings shall be internally lined with cement mortar in accordance with IS:11906/AWWA C602. Cement mortar in lining shall be applied in-situ after pipe laying and after sectional hydraulic testing.

Cement shall be Portland cement in accordance with IS 8112

Sand used for lining shall be tested with standard sieves as per IS 460 and requirements specified in IS 11906

The minimum cement content shall be 100 kg/m3 and the water : cement ratio by mass shall be between 0.3 and 0.45:1

The mortar shall stop 100 mm back from the faces of any joints. The end face shall be vertical.

6.12.1 Surface Preparation

The interior surface of the pipe to be lined shall be cleaned to remove all rust, chemical or other deposits, oil, grease and all accumulations of water, dirt, and debris. The cleaning of the surface shall be carried out by the use of suitable chemical or mechanical means to the approval of the Engineer. The extent of cleaning shall be to the satisfaction of the Engineer.

All loose mill scale, dirt, rust, and accumulation of construction debris shall be removed from the interior of the steel pipeline. The pipeline shall be cleaned by use of a power-driven cleaner incorporating revolving brushes on rotating arms.

Immediately prior to the travel of the lining machine through the pipeline, all foreign material shall be removed. This includes small sand and loose mortar that might have accumulated since the work of preparation of surfaces was completed.

6.12.2 Mix Proportion

Proportion of sand to cement shall not be more than 1.5 parts sand to 1 part by volume. Mortar composing of cement, sand and water shall be well mixed and of proper consistency to obtain a dense, homogeneous lining that will adhere firmly to the pipe surface. The cement mortar mix shall comply with strength and density requirements specified in IS 11906/AWWA C602. No admixtures shall be permitted unless approved by the Engineer.

6.12.3 Thickness of Lining

The lining shall be placed by centrifugal method in one course by a machine traveling through the pipe and discharging the mortar at a high velocity over all pipe sections and long radius bends. The discharge shall be from the rear of the machine so that the freshly applied mortar will not be marked. The rate of travel of

the machine and the rate of mortar discharge shall be mechanically regulated so as to produce uniform thickness throughout. The mortar must be densely packed and shall adhere to the pipe wherever applied.

6.12.4 Surface Finish

Mortar lining shall be mechanically trowel led except for the places where hand toweling is expressly permitted by the Engineer.

The lining shall be provided with attachments for mechanically trowel ling the mortar. Both the application and toweling of the mortar shall take place at the rear of the machine so that the freshly placed and trowel ling of the mortar will not be damaged. The trowel attachment shall be such that the pressure applied to the pipe will be uniform and produce a lining of uniform thickness with a smooth and even finished surface free of spiral shoulders. The finished surface of machine placed and trowel led linings in pipe shall be examined according to the following procedure.

Thickness of lining shall be ascertained frequently during placing of mortar and trowel ling using an approved non-destructive method.

In the stretch of pipe that has been lined and trowel led in each day’s run, ten places shall be selected in straight sections of the pipe by the Engineer. In each of the ten places the thickness of the lining shall be re measured by non-destructive means as directed by the Engineers.

Defects in lining including but not restricted to sand pockets, voids, over sanded areas, blisters, cracked and dummy areas, and thin spots shall be removed, and the area shall be repaired to the full required thickness of the mortar lining. Defective areas encompassing the full diameter to the pipe shall be replaced by machine. Defective lining rejected at the time of lining shall be removed before initial set of the mortar. Defective lining rejected after initial set shall be replaced or repaired by the most practical method as determined by the Engineer.

Hair cracks or cracks up to 0.25 mm width and not over 300 mm in length in finished linings may be considered acceptable at the discretion of the Engineer but larger cracks shall be repaired or removed and redone all as directed by the Engineer.

6.12.5 Hand application

Cement mortar lining of bends, specials, areas closely adjacent to valves and other such places where machine placing may not be practical shall be performed by hand. The Engineer may order the correction for any defect by hand application.

Cement mortar for hand work shall be of the same materials as the mortar for machine placed lining.

The areas to be lined shall be thoroughly cleaned as specified earlier and, if necessary, shall be moistened with water immediately prior to placing the hand-applied mortar.

Steel finishing trowels shall be used for the hand application of cement mortar, except at bends the outer edges of hand trowel led areas may be brushed in odder to reduce the abutting offset.

All hand finishing work in a section of the pipeline shall be completed within 24 hours after completion of the machine application of mortar lining that section. If necessary, application of mortar lining by machine shall be delayed or stopped to assure compliance with this schedule.

Hand placed mortar shall have a uniform and smooth surface with smooth transitions to adjacent machine placed linings.

6.12.6 Curing

Curing shall commence immediately after completion of the mortar lining and hand finishing of a section of pipeline. This shall, not be later than 8-hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of 14 days. During the operation of lining, finishing and curing, exterior surface of the pipe exposed to sunlight shall be sprinkled with enough water to keep the pipe cool. Open ends of pipes shall be suitably closed so as to maintain a moist atmosphere and prevent draught. Curing of mortar lining and simultaneous cooling of the pipeline externally shall be continued even beyond the period of 14 days if so directed by the Engineer.

6.12.7 Tests

Test blocks of the same material as used for the lining shall be made in 150 mm cube moulds and subjected to cube crushing tests. Each block shall be removed from its mould as soon as practicable and cured under the conditions of temperature and humidity identical with those in which the lining of the pipe is cured. The number of tests shall be at least 4 cubes for each age and water cement ratio for each days work. The work cube strength of the test cube shall not be less than 300 kg/cm^2 after 28 days of curing or 170 kg/cm^2 of 7 days of curing. The density of the test cube shall not be less than 2300 kg/m^3

6.12.8 Backfilling

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be started by the contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall

be taken during backfilling, not to injure or disturb the pipes, joints or coating. filling shall be carried out simultaneously on both sides of the pipe so that unequal pressure does not occur. walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material, up to height of at least 300 mm over the top of the pipe except as may be necessary for trapping etc., during backfilling work.

The remaining portion of the trench shall be filled in which selected excavated material free from and topsoil, vegetation or boulders and colds of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95 % of the maximum dry density as per Part 7 of IS: 2720. The water contents of the soil shall be kept near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due allowances for subsequent settlement likely to take place. The surface of the refilled excavation shall be left slightly higher than the adjacent ground and be maintained by the contractor to a smooth even slope.

The Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be used.

If suitable material for refilling is not available from already excavated material the Contract shall import material of approved quality as directed by the Engineer.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval for the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during

The works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200mm thick after compaction. The method of compaction employed shell achieves not less than 90% maximum dry density as determine from IS 2720: Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

6.12.9. Trenchless technology

Where pipes are to be laid below the road crossings and railway crossings shall be installed using trenchless technology, which include construction of shafts and other associated Structures.

The trenchless technology method adopted by the Bidder shall be such that the surface settlement measured directly above the front face of the shield or boring equipment during the Jacking\/ boring operations does not exceed 15mm. The affected ground and the structures shall be subsequently reinstated to their original condition at Contractor’s risk and cost.

However, for the sections of pipe crossing under roads and railways the Contractor shallbe required to incorporate in his trenchless method measures to arrest the expected settlements so as to safeguard the integrity of the road/railway surfaces and collapse of bed. The Contractor shall ensure that the traffic flow along the roads/railway track is not affected by ground settlement or upheaval in any way as a consequence of his work.

Different trenchless technologies are used for different diameter, material ofconstruction of pipe and site conditions. These are explained in the table below

S. no	*Diameter of pipe*	*Suitable trenchless technology*
1	*< 1000mm*	*Guided boring*
2	*1000- 1500mm*	*Pipe jacking*
3	*>1500mm*	*Tunnel boring*

Reference: Table 3.29- Criteria for selection of trenchless technology

6.12.8.1 Guided Auger Boring

Auger boring is a technique for forming a horizontal bore under a crossing, using a cutting head and auger flights. The auger boring equipment consists of a cutting head attached to a helically wound auger flight. The rotation action of the auger flight simultaneously rotates the cutting head and removes the excavated soil from the bore. The auger flight is contained within a steel casing.

In auger boring, the auger rotates inside the casing as it is jacked. Hence there is a danger that it may damage any interior coating or liner that may be in the pipe. The standard casing material used with auger boring is steel. Presently, most of the rail road and highway specifications require the use of steel casing with auger boring. The cutting head 4595 and auger are rotated from the drive pit by a transmission or power unit. Most auger boring systems include pipe jacking equipment, which allows the casing to

be moved forward as the cutting head advances. Once the casing has been installed the product pipe can be inserted.

The size of pipe that can be installed by this method ranges from 100 mm to more than 1,500 mm. however, the most common size range 200 mm to 900 mm

6.12.8.2 Pipe jacking

Pipe jacking is a trenchless construction method which requires workers inside the jacking pipe. The jacking is generally started from an entry pit. The excavation can be done manually or by using machines. However, it is accomplished with workers inside the pipe. The excavation method varies from the very basic process of workers digging the face with pick and shovel to the use of highly sophisticated tunnel boring machines. Since the method requires personnel working inside the pipe, the method is limited to personnel entry size pipes. Hence the minimum pipe diameter recommended by this method is 1060 mm outside diameter

Irrespective of the method, the excavation is generally accomplished inside an artificial shield which is designed to provide a safe working environment for the people working inside and to allow the bore to remain open for the pipe to be jacked in place. The shield is guidable to some extent with individually controlled hydraulic jacks

The first step in any pipe jacking operation is site selection and equipment selection asper the site requirements. A pipe jacking project should be planned properly for a smooth operation. The site must provide space for storage and handling of pipes, hoisting equipment for the pipe, spoil storage and handling facility, etc. If adequate space is available, a big jacking pit is preferred so that longer pipe segments can be jacked and the total project duration is reduced

The jacking pit size is a function of pipe diameter, length of pipe segment, shield dimensions, jack size, thrust wall design, pressure rings and guide rail system. The space available at the site governs the selection of all the above components. The jacking pit should be shored and braced unless it is very shallow and high strength clay. It can be shored with timber, steel piling, or shaft liner plates. Due to the jacking forces required to push large diameter pipes through the ground, the jacking pit design and construction are critical. The pit embankment supports must be properly designed and constructed. It is critical that pit floor and the thrust reaction structure be designed to withstand the weight of the heavy pipe segment repeatedly

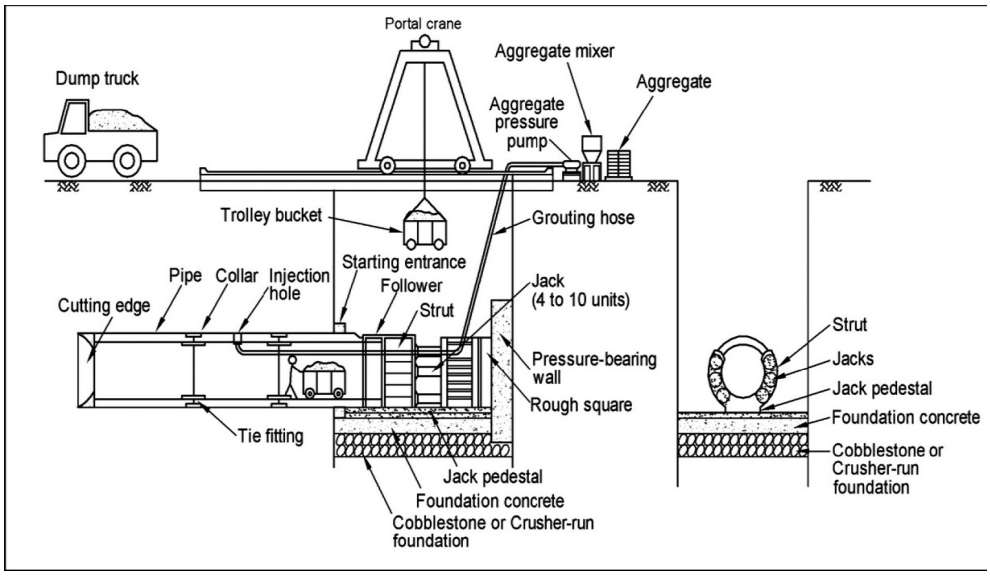
placed on it as well as the continuously exerted jacking loads as the operation is being conducted

Preparation of the floor of pit, i.e. soil, stone or concrete slab will be determined by the length, size and/or duration of the job. The final alignment and grade will depend to agreat extent on the initial setup. Therefore, it is advisable to set up a concrete slab foundation for large jobs which are likely to take a long time. The pit should have space for personnel to walk on both sides of the pipe. It is important that the pit should be dry and dewatering provisions should be considered

One of the major factors that affect pipe jacking is the jacking force required to push the pipe inside the soil. Every effort is made to minimize the thrust. Application of bentonite to the outer skin of the jacking pipe reduces the friction between the jacking pipe and the soil which reduces the thrust requirements

The use of intermediate jacking stations (IJS) is common to control or increase the jacking forces. There is no limit to the number of IJS that can be installed in a line. TheIJS permit the pipe to be thrust forward in sections rather than the total length being thrust forward from the jacking pit.

The manual pipe jacking method is suitable for diameter up to 1500 mm. For largediameter, manual jacking is not advisable as grade and alignment maintenance may not bepossible in such cases. For such works mechanical techniques like utility tunnelling/Tunnel Boring Machine (TBM) may be chosen. A typical trenchless pipe jacking method is shown in following Figure.



Source: JSWA, 2011 - Figure :Trenchless pipe jacking

6.12.8.3 Tunnel Boring / Utility tunnelling / Trenchless Technology

Tunnel boring is pipe jacking method only but, in this method, instead of manual excavation; highly sophisticated tunnel boring machines are used for excavation. It is generally used for diameter higher than 1,500 mm and where proper slope / gradient is required.

SECTION 8:

DRAWINGS

SECTION 9:

BILL OF QUANTITIES

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees and excluding GST.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITT Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITT Clause 24.1 (b)]

SECTION 10:
FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [63]_Rupees_____ _____[in words], and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee][64] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.
We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.
Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

[63] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

[64] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

Contractor
Employer